Technical Report 650

Formative Evaluation of an Adaptation of the Feuerstein Instrumental Enrichment Program in the US Army Basic Skills Education Program (BSEP II)

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Research Institute for the Behavioral and Social Sciences

October 1984

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: ARI Technical Report 650	2. GOVT ACCESSION NO.: ADA171540
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): FORMATIVE EVALUATION OF AN ADAPTATION OF THE FEUERSTEIN INSTRUMENTAL ENRICHMENT PROGRAM IN THE US ARMY BASIC SKILLS EDUCATION PROGRAM (BSEP II)	5. TYPE OF REPORT & PERIOD COVERED: Final Report Nov 1981 - Mar 1983
	6. PERFORMING ORG. REPORT NUMBER: --
7. AUTHOR(s): Darlene F. Russ-Eft, Donald H. McLaughlin, Rebecca L. Oxford-Carpenter, Joan Harman, Zita M. Simutis, and Gail L. Baker	8. CONTRACT OR GRANT NUMBER(s): MDA 903-81-C-AA04
9. PERFORMING ORGANIZATION NAME AND ADDRESS: American Institutes for Research, P.O. Box 1113, 1791 Acastradero Road, Palo Alto, CA 94302	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 2Q263743A794, Task Area 3346, Work Unit No. 53
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue, Alexandria, VA 22333-5600	12. REPORT DATE: October 1984
	13. NUMBER OF PAGES: 117
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office): --	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: --

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

--

18. SUPPLEMENTARY NOTES

This research was technically monitored by Joan Harman.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Learning strategies	Basic Skills Education Program
Instrumental enrichment	Feuerstein
Cognitive skills	Training
Basic skills	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is a formative review of an adaptation of Feuerstein's Instrumental Enrichment Program within the context of the Army Basic Skills Education Program (BSEP II). Significant deficiencies in program implementation were uncovered including inadequate teacher training and materials, and insufficient classroom time. Practical problems, theoretical issues, and implications for future research are explored in this report, which will be of relevance to persons interested in military training and education.

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5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
Department of the Army

October 1984

Army Project Number
2Q263743A791

Evaluation of the Basic Skills
Education Program

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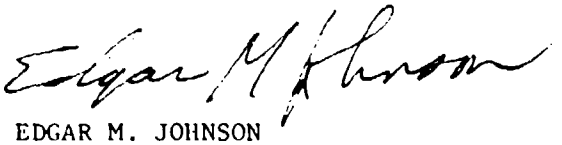
FOREWORD

The Curriculum and Evaluation Team in the Instructional Technology Systems Technical Area of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) performs evaluation and curriculum development with applicability to military education and training. Of special interest is the formative evaluation of a pilot program on the teaching of learning strategies at Fort Knox, KY. Because learning strategies training is seen as a potential solution to some of the cognitive skill deficits that prevent certain soldiers from succeeding in the Army, it is essential to conduct a comprehensive evaluation of such training.



EDGAR M. JOHNSON
Technical Director

FORMATIVE EVALUATION OF AN ADAPTATION OF THE FEUERSTEIN INSTRUMENTAL ENRICHMENT PROGRAM IN THE U.S. ARMY BASIC SKILLS EDUCATION PROGRAM (BSEP II)

EXECUTIVE SUMMARY

Requirement:

Large numbers of American youths leave the education system lacking the knowledge and basic skills needed to function effectively in careers. The Army has accepted many of these youths with the expectation that they will develop the necessary skills in the context of an Army career. To address these needs, the Army developed the Basic Skills Education Program (BSEP). In addition to deficiencies in specific skills such as reading, language arts, and computation, there are more general deficiencies in underlying cognitive skills or learning strategies--problem definition, analytical thinking, and systematic planning, for example. The U.S. Army Training Developments Institute of the Training and Doctrine Command (TDI, TRADOC) adapted the Instrumental Enrichment (IE) Program developed by Israeli psychologist Reuven Feuerstein for a demonstration at Fort Knox, KY, to teach such cognitive skills to soldiers. The current research was undertaken with the intent of providing a comprehensive, formative evaluation of this demonstration.

Procedures:

The procedures used in this formative evaluation included observations, interviews, and cognitive tests. Pre- and post-measures on soldiers included standardized tests (Armed Services Vocational Aptitude Battery (ASVAB), and Test of Adult Basic Education (TABE)), commanders' ratings, and an ARI/AIR-developed test of cognitive functioning based partly on Feuerstein's instruments. Before and after the demonstration, assessments were taken of adequacy of teacher training and of teachers' reactions to IE. Before instruction, ARI/AIR conducted a comprehensive review of the IE materials adapted for Army use. During instruction a number of measures were used--teachers' records of student exposure to IE, attendance records, student performance on IE materials, teachers' self-evaluations, and ARI/AIR structured observations. BSEP cycles from November 1981 through April 1982 were involved in the demonstration and the evaluation.

Findings:

As expected, students improved their reading, language arts, and computation skills during the BSEP cycle, as measured by the TABE. However, these gains were not related to gains either in general cognitive skills or in specific abilities to perform IE exercises. In fact, scores on Organization of Dots, the IE instrument on which greatest gains occurred, were not correlated with the scores on the TABE or with General Technical (GT) scores on the ASVAB. Thus, it appears that this particular adaptation of IE addressed

skills different from those needed for short-term gains in standardized tests. The Army's adaptation of IE showed low fidelity to Feuerstein's original program. Therefore, from this demonstration it is not possible to assess definitively the potential of IE for improving soldiers' performance either on standardized tests or on the job. The demonstration did show the need for improvements in both teacher training and materials, and the need for a greater amount of classroom time for the adaptation to be more faithful to the original model and to be more effective.

Utilization of Findings:

The information generated by this demonstration and its evaluation by ARI/AIR has been shared in written and oral forms with other parts of ARI and the Department of the Army involved in examining IE for Army use. New instruments developed for the evaluation have been given to current users and are also available in the report. With regard to utilization, the most important aspects of the evaluation are the findings concerning proper and effective implementation of a program of this type in an Army setting.

FORMATIVE EVALUATION OF AN ADAPTATION OF THE FEUERSTEIN INSTRUMENTAL ENRICHMENT PROGRAM IN THE U.S. ARMY BASIC SKILLS EDUCATION PROGRAM (BSEP II)

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INTRODUCTION

Large numbers of American youths leave the educational system lacking the basic knowledge and skills they need to function effectively on the job. The US Army accepts many of these youths with the expectation that they can acquire the necessary skills for job success. To address these needs, the Army developed the Basic Skills Education Program--BSEP I for soldiers in basic training, and BSEP II for soldiers who have completed AIT or OSJT.

In addition to deficiences in reading, writing, and computing skills, soldiers exhibit more general deficiencies in underlying cognitive skills. Teaching these cognitive skills--often called learning strategies--requires methods different from those used for teaching reading, writing, and computation. One comprehensive method is the Instrumental Enrichment (IE) Program developed by Israeli psychologist Reuven Feuerstein (1980).

The IE Program consists of a set of 14 "instruments" or exercise booklets that can be used to teach basic cognitive skills, such as problem definition, analytical thinking, systematic planning, systematic searches, perceptual precision, and learning processes. These instruments have been used successfully with culturally deprived adolescents, leading to increased scores on standard tests (Feuerstein, 1980). They were particularly successful in producing long-term rather than immediate gains.

To examine IE in the context of BSEP, the Army funded an exploratory demonstration project at Fort Knox.[1] Because the instruments were originally

[1]The Army Training Developments Institute provided funding to Curriculum Development Associates to develop the demonstration and to Battelle to conduct a preliminary evaluation (Rosinger, Myers, & Levy, 1982). The Army Research Institute requested the American Institutes for Research to conduct a more extensive evaluation of the demonstration program under a contract for an overall BSEP evaluation.

designed to be used in a longer two-year program and with a younger population, their use in BSEP II required adaptation.

Description of the Instrumental Enrichment Program

Reuven Feuerstein based the IE program on his experiences of more than twenty years with Israeli adolescents who were retarded in their intellectual performance; they had had limited opportunities to learn, disrupted lives, and diverse cultural backgounds. He worked with the Youth Aliyah, the agency responsible for the integration of Jewish children in Israel. These children, some from primitive cultures in Asia, Africa, and Europe, were classified and schooled for citizenship in a modern, technological society. A variety of tests had been used as the basis for classification and planning of schooling, but these tests only measured what the children had learned, not what they could learn.

Feuerstein developed a sensitive test of basic cognitive functions that affect learning, the Learning Potential Assessment Test, and then transformed the test into a training device. Eventually he developed the IE program "to change the overall cognitive structure of the retarded performer by transforming his passive and dependent cognitive style into that characteristic of an autonomous and independent thinker" (Feuerstein, 1980, p.1). This approach assumes that "cognitive modifiability" can occur through mediated learning experiences as well as through direct exposure to sources of stimuli.

According to Feuerstein, retarded cognitive performance results when the essential products of a culture are not transmitted to an individual, leaving the person "culturally deprived." Such a person exists in a state of reduced

cognitive modifiability, even when directly exposed to sources of stimulation, because he or she does not possess the cognitive functions to assimilate the situation. Furthermore, he proposed that cultural deprivation does not result directly from distal determinants, such as genetic factors, organicity, level of environmental stimulation, and socioeconomic status. Rather, there is a crucial proximal determinant, lack of mediated learning experiences, that causes inadequate cognitive development. The distal determinants operate by causing the lack of mediated learning experiences.

According to Feuerstein's theory of mediated learning experiences, retarded cognitive performance is a reversible condition. The necessary intervention can be undertaken at any age and is directed at eliminating deficient functioning. This is accomplished by providing mediated learning experiences structured according to the individual's needs. Students work on content-free exercises, and teachers carefully attend to the students' responses to overcome blocks and to facilitate generalization of acquired skills.

The IE program rejects direct training for routine mechanical skills. Instead, it aims "to develop in the organism a state of modifiability" (Feuerstein, 1980, p.70). This permits the individual to function and adapt to a normal environment, so that the need for long-term continuing remedial programs is eliminated. While the IE program was developed for use with adolescents, Feuerstein claims that "the underlying principles of the program are applicable to all ages" (Feuerstein, 1980, p. 69).

Rationale for Use of IE in BSEP

BSEP exists within the Army Continuing Education System (ACES). This system supports and develops the individual in four ways:

- By enhancing the soldier's professional development, military effectiveness, and leadership abilities
- By preparing soldiers for positions of greater responsibility in the Army
- By preparing soldiers for productive post-service careers
- By increasing soldiers' self-esteem and motivation for continued learning.

BSEP concentrates on developing the skills of Army recruits and other soldiers who demonstrate low levels of reading and math skills. It was designed "to develop educational competencies required for a soldier's job performance, skill qualifications, and career growth" (Army Regulation No. 621-5). It provides on-duty, job-related basic skills development:

- To increase the likelihood of good performance by the soldier in training and on the job
- To improve the soldier's capability of functioning effectively in the Army community
- To increase the soldier's potential for pursuing and completing other educational and training programs.

BSEP, therefore, is an enabling rather than a supplementary program; it prepares soldiers to learn from the regular training programs.

Because the BSEP focus on teaching learning strategies appears to be consistent with the goals of the IE program, the Army funded the exploratory demonstration project at Fort Knox to determine the feasibility and value of IE in the context of BSEP.

Feuerstein (1980) identified 22 cognitive functions, and Link (1981) evaluated the BSEP II population at Fort Knox to identify cognitive functions

with the greatest deficiencies. On the basis of this needs assessment, Link selected parts of nine of the 14 IE instruments for adaptation for BSEP use in a shortened IE program:

- o Organization of Dots--Dots to be organized into geometric figures
- o Orientation in Space I--Objects and symbols to be located in space and in relation to one another, using left, right, front, and back
- o Comparisons--Use of pictures and words to compare two items on discrete dimensions
- o Analytic Perception--Geometric forms used to teach the analysis of a whole into its component parts, the relationship between the parts, the viewing of each part as a whole unto itself, and the possibility of uniting the parts into new wholes
- o Illustrations--Collection of pictorial situations depicting problems that must be defined and solved
- o Instructions--Verbal instructions to be read and carried out
- o Categorization--Items that are verbal, pictorial, figural, and schematic to be organized into categories
- o Numerical Progression--Pictorial, numerical, and graphical items used to develop the need to perceive disparate objects and events as being linked in a relationship that can be deduced
- o Orientation in Space III--Picture and word problems used to determine the orientation of an object directly or as inferred from knowledge of the internal relationship between north, south, east, and west and their positions relative to one another.

It should be emphasized that in most cases, the instrument "content" is merely a medium; the teaching objectives concern processes such as planned problem solving, attention to cues, organization, and comparison. Each instrument consists of approximately thirty pages, and each page contains from one to twenty problems to be solved. An accompanying teacher's manual specifies objectives, subgoals, and procedures for using each page of problems.

Descripton of Demonstration

The demonstration involved nine experienced teachers and 118 BSEP II students in the training cycle that began on 9 November 1981, six of the nine teachers and 44 students in the training cycle that began on 4 January 1982 (including 23 students continuing from the previous cycle), and six teachers and 47 students in the cycle that began on 1 March 1982 (including 17 of the 47 students continuing from the previous cycle). The teachers received instruction from two master teachers during three three- to five-day sessions during August and September 1981, and they experimented with some of the IE instruments in their classes between August and October 1981.

The nine teachers were employed by a nearby community college. They were certified, although not necessarily in the subject area that they were teaching. They taught soldiers in three seventy-minute periods each day, five days a week, for either six- or 12-week sessions during the November-December cycle and for either eight- or 16-week sessions during the January-February and March-April cycles. Students with especially low GT and TABE scores were assigned to 12- or 16-week cycles; students with higher scores were assigned

to six- or eight-week cycles. All instruction took place on post, during on-duty time, in or near the post's Education Center.

The nine teachers can be considered in three groups. Two of these groups actually functioned as three-teacher teams, covering English, math, and science; students moved from teacher to teacher in seventy-minute periods. One of the teams taught the students in the 12- or 16-week cycles during their first six or eight weeks. The other team taught these students during the second half of their cycle, and also taught those enrolled for only six or eight weeks. These two teams implemented the IE program throughout the entire period of the demonstration. They will be referred to as Team 1 and Team 2. It should be emphasized that because these two teams were addressing different skill objectives, they could not be compared with each other.

The remaining group of three teachers had students for the entire three hour period--one English-as-a-Second-Language (ESL) teacher, one basic reading teacher, and one General-Educational-Development (GED) teacher. They will be referred to as Team 3. These teachers began by implementing IE, but discontinued the program after December. The ESL and basic reading teachers believed that their students required prerequisite skills of English comprehension and reading ability prior to involvement in the program. Furthermore, they felt that IE instruction would be redundant because some of the soldiers in these classes eventually would move into the classes taught by the Team 1 and Team 2 teachers. The GED teacher felt that the pressures of preparing for the GED examination prohibited spending time on IE.

There were several practical reasons why a control group could not be used in this study, although GT and other scores can be compared with scores

from a Fall 1980 cycle. Trying to divide one teacher's classes between treatment and control (a within-teacher comparison) would be questionable, because the IE techniques such as bridging and teaching systematic planning behavior actually constitute a teaching style and are difficult to suppress once acquired; therefore, any test of impact would be diluted by the teacher's use of the IE methods with the control students. Selecting one of the two three-teacher teams as a control (a between-team comparison) would suffer from the fact that these teachers did communicate with each other, and any IE effect would be likely to spread. Finally, treatment differences would be completely confounded with teacher differences and with student prerequisite ability differences.

As an alternative to a true experimental design with a control group, a quasi-experimental design was used. Campbell and Stanley (1963) recognize the one-group time-series design as providing useful information, particularly if one maintains accurate records of the historical variables affecting the results. Such a design employs periodic measurements to determine the effects of an experimental operation. In the present study, this design was extended to include two parallel teaching teams using IE and provided a measure of the variation in effectiveness of IE in the hands of different teachers as well as a mean level of effectiveness. However, because this evaluation focused primarily on the problems encountered in IE program implementation, any conclusions that might be drawn from comparisons of group gains would be inappropriate. In future IE program evaluations, a carefully selected control group would provide such additional information.

The IE program demonstration that was conducted in the context of ongoing activities at Fort Knox was affected by four administrative and procedural problems. First, it became clear by December that the teachers were

dissatisfied with the implementation schedule. One of the trainers and an AIR staff member worked with the teachers to revise both the program, by reducing the required number of pages per instrument, and the teaching load, by assigning certain teachers to teach certain instruments. Second, some soldiers who returned from previous cycles had already done certain IE exercises; but all of the exercises were new for the entering soldiers. Third, the Army contract with the community college was due for renewal in November, and the proposal was due in February. In March the teachers learned that the community college had lost the contract. Thus, their future employment was uncertain. Fourth, the teachers felt that their primary responsibility was to help the soldiers raise their GT or GED scores in the short-term--not "to change the overall cognitive structure of the performer by transforming his passive and dependent cognitive style into that characteristic of an autonomous and independent thinker" (Feuerstein, 1980, p.1). It is important that the demonstration data be interpreted in the context of all four of these contingencies.

Issues

Given the context of BSEP in which IE was to be evaluated, two questions had to be considered:

- Are there deficiencies in soldier job performance that can be traced to deficiencies in cognitive functioning?
- Can IE training help to remove these deficiences, and thus result in gains in soldier performance?

Since both of these questions must be addressed indirectly, a model of the IE demonstration was developed. At the simplest level, we can assume that completion of the IE program leads to proficiency in cognitive skills. If there were initial deficiencies, IE should lead to gains in performance as assessed by appropriate tests. This simple model is depicted in Figure 1.

This model is, however, incomplete. The IE program, like any other educational program, is heavily dependent upon the effectiveness of its implementation. This effectiveness is affected in turn by three factors--class time and other resources, the program materials, and the teacher preparation in the new program. Class time and other resources are determined by the design of the BSEP program (for example, total number of classroom hours) and by the design of the IE program (for example, total number of classroom hours required). The adequacy of the design of the IE program for BSEP also affects the acceptability of the IE materials for an adult population and the effectiveness with which a shorter implementation period is used. The design of the IE program, particularly the teacher training sequence, as well as the teachers' prior skills and experiences, affect the level of teacher preparation to use IE. This expanded model is shown in Figure 2.

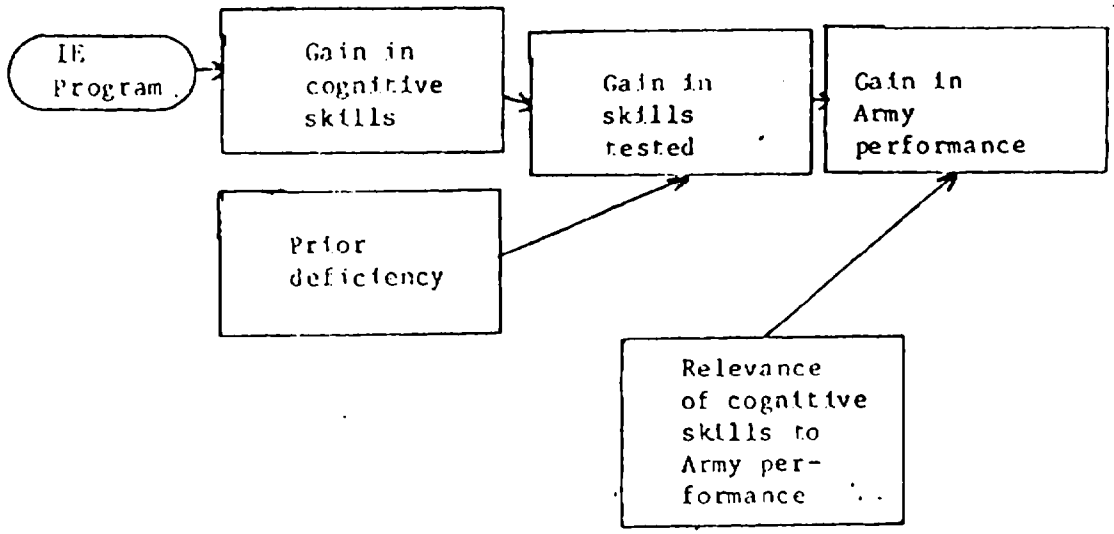

Figure 1. Simplified model of the implementation of IE in BSEP II at Fort Knox.

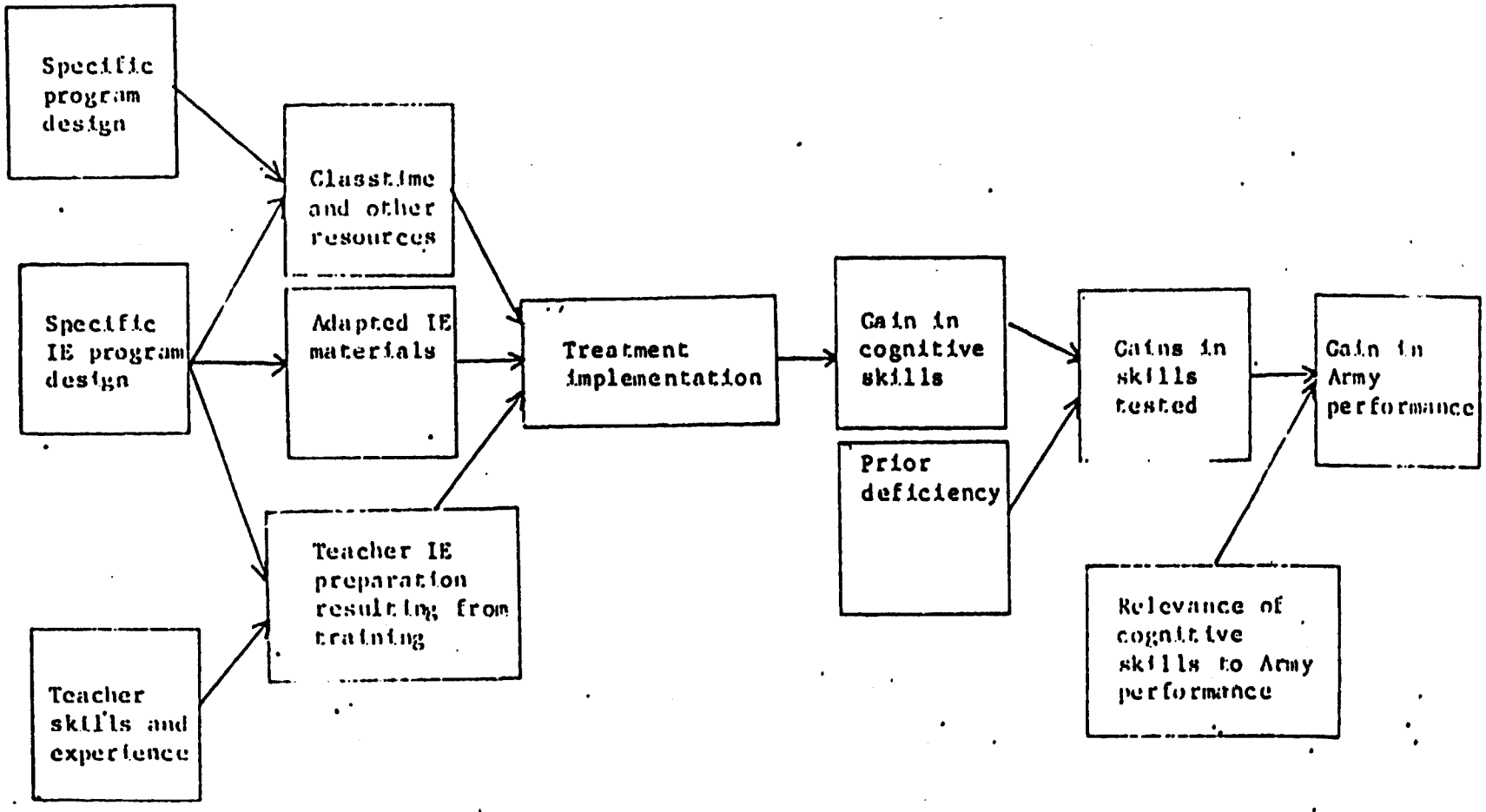

Figure 2. Expanded model of the implementation of IE in BSEP II at Fort Knox.

However, student gains in cognitive skills do not depend solely upon the treatment implementation. If they are not motivated to learn, or if they lack certain prerequisite skills, the treatment may be ineffective. Although IE is designed to require few prior skills, the actual manifestation of gains on criterion tests may involve, for example, English language reading abilities not covered. Therefore, gains due to IE may not be measurable for ESL students or for students with extremely low reading achievement.

The fully expanded version of the IE demonstration model that includes several additional factors is shown in Figure 3. The factors outlined with solid lines have been measured and are discussed in this report. The two factors outlined with broken lines have not been measured; both were beyond the scope of this process-oriented evaluation. However, these factors are important from the standpoint of implementing IE in BSEP. Unless gains in cognitive skills and learning strategies actually result in gains in soldier performance, the Army cannot expect a reasonable return on its investment in the program. Thus, further research is needed to determine the actual relevance of the cognitive skills taught by IE to Army job performance.

Using this model, the two broad issues initially considered can be expanded into a series of subordinate issues focusing specifically on the Fort Knox implementation. The first question, regarding deficiencies in soldier performance traced to deficiencies in cognitive functioning, can be examined in two parts:

- Were there deficiencies in any of Feuerstein's 22 cognitive functions among BSEP soldiers?
- Were these cognitive functions relevant to performing Army tasks?

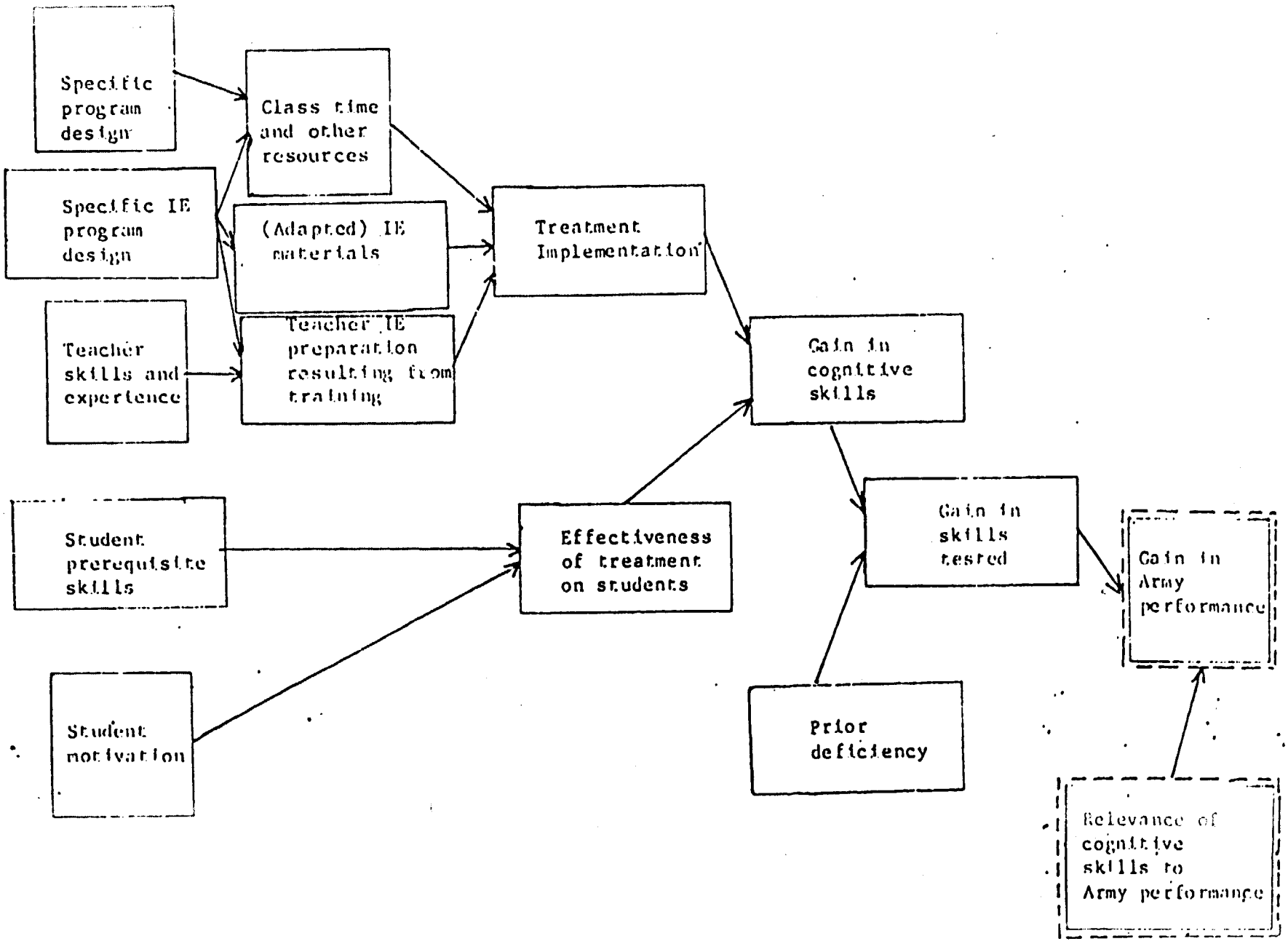

Figure 3. Final model of the implementation of IE in BSEP II at Fort Knox.

The first of these subquestions was addressed by Link in her needs assessment report (Link, 1981). She identified the following deficiencies as most prominent:

- o Difficulty in discovering and projecting the relationship between two items
- o Lack of constancy or conservation of size, shape, and orientation in space
- o Cognitive impulsivity--information is not reviewed systematically
- o Failure to recognize need for precision
- o Inadequate strategies for checking one's work
- o Difficulty in spatial and temporal sequencing and lack of labels to describe spatial orientation
- o Difficulties in both structural and operational analysis--disembedding or locating and identifying simple elements from within a larger organized field
- o Lack of spontaneous comparative behavior--tendency to itemize and describe rather than compare two objects
- o Inattention to detail, impulsive problem definition, and unsystematic planning behavior
- o Lack of logical thinking to help in decision-making.

While the second of the subquestions cannot be answered completely, the evaluation prepared by Rosinger, Myers, and Levy (1982) for the Army Training Developments Institute attempted to address the issue of gains in soldier performance on the job as the result of participation in BSEP and IE

training. They reported that substantial and significant gains appeared in supervisor ratings of pre- and post-BSEP job performance both in the total score and in the following subscales:

- o Confidence with mental activities
- o Planning
- o Working independently
- o Concentration
- o Spatial orientation.

The results from this study should be qualified, however. Because the gains resulted from regular BSEP training as well as from IE training, it was not possible to isolate the effects of IE. Of greater concern was the method used to gather the data. The post-BSEP measures were obtained from supervisors about six weeks after the soldiers had completed BSEP but the pre-BSEP measures were collected only one day earlier. These pre-BSEP measures were in fact retrospective reports of soldiers' behavior prior to entering BSEP. The problems resulting from this procedure, which was used because of time and schedule constraints, were recognized by Rosinger et al. (1982).

The primary objective of the present study was to address the second initial question, concerning the extent to which IE training results in gains on the cognitive functions, with regard to the cognitive deficiencies identified by Link (1981). Because the purpose of this study was not only to measure gains, but also to identify the sources of effectiveness and points for potential improvement in effectiveness, it was necessary to record measures of implementation and intermediate goal achievement. A number of specific subquestions were addressed:

- Were there sufficient class time and other resources to adequately implement the abbreviated IE program for all of the cognitive functions? If not, could some specific constraints of the BSEP program or the IE program be modified appropriately?

- Were the materials appropriately adapted for Army use in BSEP? Would it help to have more examples that are more obviously related to Army tasks? Were the materials internally consistent? What changes would be most effective in improving the instruments for use in BSEP?

- Were teachers adequately prepared for teaching the IE program? Did they know the purpose of each lesson, did they use the teacher's manual, and had they mastered the required techniques such as bridging and interpreting student difficulties? Was the teacher training method used in the Fort Knox demonstration, consisting of three three- to five-day workshops and practice for approximately six weeks, sufficient? Was more direct focus on the manual and teaching methods needed?

- Did the students have the necessary prerequisite skills to be able to benefit from the IE treatment? If not, were these prerequisite skills identified and steps taken to train soldiers in these skills?

- Do students actually work through the exercises? If not, is it because of attendance problems, because of lack of classroom time allocated, or because of motivational problems--do students become turned off by the apparent ease of some of the problems, or by the apparent irrelevance to their personal goals for BSEP participation?

- Do students generalize the skills learned beyond the specific context of the IE instruments--for example, is IE more to them than connecting the dots? If not, can this be remedied by further teacher training in IE, or is it better remedied by further development of the instruments?

The objectives of the BSEP program at Fort Knox had been to improve language arts, reading, mathematics, and science skills, as measured by the ASVAB and the TABE. The IE intervention, with its separate skill objectives, was installed within the existing BSEP program with the intention that BSEP program objectives would not be sacrificed. Since addition of the IE exercises necessarily decreased the amount of time spent on BSEP activities, whatever academic gains were identified included the compensating effects of IE.

But gains in academic skills are not the ultimate objective of BSEP. The program teaches skills important for a high level of job performance. It is here that the IE cognitive functions are also more important, since IE intends to foster problem-solving, learning, and decision-making skills as well as improving the student's self-image as a problem solver. Therefore, measures of Army job performance must also be assessed. Because this is difficult to

do in a short-term study, the conclusions reached should be rechecked during the next two years to assess lasting effects.

PROCEDURES

General Approach

The approach to the evaluation of the Fort Knox BSEP implementation of Instrumental Enrichment (IE) was entirely formative. That is, the basic objective in collecting data from observations, interviews, and tests (as presented in the 21 tables in Appendix A) was to identify potential problems in the use of IE in the Army and to recommend appropriate solutions.

As a result of this approach, it was possible to extract more information relevant to Army decision-making than would have been possible through a less flexible evaluation design. Changes were made only when significant, immediate problems occurred, and these inputs can be replicated in future implementations. Any contamination effect should be weighed against the potential loss due to a failure to immediately make a needed implementation process change. For example, development of examples of class lessons bridging from IE to subject matter--that is, relating one to the other--was based on requests from the teachers, and this may or may not have influenced the implementation. (Examples of three of these lessons are shown in Appendix B.)

In fact, there were many problems with this implementation for which immediate solutions were unavailable. Recommendations include changes in design for future adaptations of IE for use in the Army that should serve to solve these problems.

Data Sources

A number of sources of data were used in this evaluation. They included archived records of scores for both the students in the demonstration and a cohort from one year earlier, teachers in the project, students in the project, the two IE teacher trainers, the teachers' supervisor, the adapted IE materials, and classroom observations.

The data collection activities are described in three categories--prior to instruction, during instruction, and following instruction.

Measures Taken Prior to Instruction

The data collection for the cycles scheduled from November 1981 through April 1982 involved pre-measures on soldiers, measures of teacher IE preparation, and measures of the adequacy of the adaptation of materials.

Pre-measures on soldiers. Standardized tests were used, including the General Technical (GT) composite of the Armed Services Vocational Aptitude Battery (ASVAB). A Test of Adult Basic Education (TABE), generally designed to be grade equivalent and customarily administered by the community college as a part of BSEP, was also used. These measures served to assess the contribution of IE to the achievement of standard BSEP objectives. Similar sets of scores on the students in the fall and winter 1980 cycles were retrieved from files.

The soldiers were also tested on cognitive functions identified in Link's needs assessment (Link, 1981). This was done by using a combination of two tests--exercises selected from the IE instruments, and items developed to measure the functions in Army contexts. Because of scheduling difficulties, these tests could not be prepared for administration at the beginning of the November 1981 cycle. They were administered in the middle and at the end of that cycle, and they were used for the pretests and posttests in the January-April 1982 cycles. These tests were administered by the BSEP teachers. The IE Test adapted from IE materials by the research staff is included in Appendix C; the Cognitive Skills Test, also developed by the research staff, is included in Appendix D.

Measures of teacher IE preparation. Assessments were requested of the teacher trainers and of the teachers' supervisor regarding the extent to which the teachers were prepared for using IE exercises and were motivated to use them. These requests focused on an evaluation of the teachers' IE preparation rather than a more global evaluation of the teachers in order to promote their cooperation.

Teachers were also asked for self-assessments regarding preparation, and the depth of their understanding of the objectives of a sample of the IE units to be taught.

Measures of the adequacy of the adaptation of materials. The materials provided to the teachers were examined by the project staff to identify problems in consistencies and to suggest possible improvements. Participating teachers were also asked to identify problems with the materials.

Measures Taken During Instruction

The primary purpose of data collection during the instructional period was to identify sources of any problems that occurred, and to develop recommendations for improvements that might be made in a replication of the demonstration or in further development of IE as a BSEP strategy. The sources of the data needed were the IE instruments as completed by the soldiers, teachers' records of dates on which exercises were administered, attendance records, and observations of classroom instruction.

The classroom observations were conducted by one or two researchers. The first observations were conducted jointly in October. The remaining observations in November and April were conducted by one observer, and those in December and February by the other. No systematic differences appeared in the data reported by the two observers. A copy of the Classroom Observation Form is included in Appendix E.

Measures Taken Following Instruction

Measures taken following instruction were virtually identical to those gathered prior to instruction, with the exception of the analysis of the materials. Teacher preparation as well as student performance were reassessed, to determine whether greater gains might be expected in a replication of the demonstration due to greater teacher familiarity with the materials and their use, and whether the summer cycle training was sufficient or whether an expanded training segment should be considered.

Problems arose with the receipt of some of the posttest materials. When the program administrator moved from Fort Knox because of a change in contractors, some of the cognitive tests were lost; these tests were

readministered for the primary analysis group. No such step was undertaken for the other groups because of the difficulty in interpreting data from the time when IE was implemented sporadically or inconsistently.

Finally, each teacher and some of the students were asked for their opinions about the IE program.

A summary of the data collection instruments, the data sources, and the procedures developed is presented in Appendix A, Table A-1.

RESULTS

The results can be examined according to three categories--observation of the IE teacher training process, observation of the implementation of IE, and measurement of student gains.

Observation of the IE Teacher Training Process

The results of the interviews with BSEP teachers can be categorized according to positive outcomes of training and options for improving training. In the first category, both teachers' opinions about the materials and training and their plans for implementing particular exercises are considered. Comparison of the teachers' opinions and plans with outcomes intended by the teacher trainers yielded points of discrepancy, which can be used to refine future training procedures.

In the second category, teachers' direct opinions on ways to improve the training and the applicability of IE to BSEP are presented. The opinions of experienced teachers can be a valuable source of ideas for refinement of methods.

These results are then translated into a set of recommendations concerning teacher training for IE.

Positive outcomes of IE teacher training. This training provided the teachers with information on and experience in new teaching materials and methods. The teachers' general opinions regarding the most important thing they had learned are presented in Table A-2.

Two of the teachers made three positive comments; only one teacher made none. In addition to learning about the new IE instruments and methods for using them, they also learned about new ways of presenting and organizing the instruction and about new concepts to be used in teaching. One teacher expressed appreciation for having two trainers with very different teaching styles. Other teachers mentioned that the training provided some reinforcement for continuing their work.

The teachers were also asked, "Which of the IE instruments do you expect the most success with in BSEP?" All teachers indicated at least one instrument, and one teacher mentioned five of the instruments. The responses reflected the emphasis that we observed in the training, which included several days on Organization of Dots. In addition, the teachers identified instruments that were interesting and challenging for adults, provided easy bridges into the subject matter, and emphasized technical skills needed in the Army.

In an effort to determine plans for using specific IE exercises, each teacher was then asked to select a single page from a single instrument to discuss. The instruments selected included Organization of Dots, Orientation in Space I, Instructions, and Numerical Progression. In making selections, the teachers tended to pick a favored instrument. Other reactions concerned difficulty, relevance to the world today, and usefulness in basic subject. Only one teacher, who picked the instrument Instructions, indicated disagreement with the way in which it was written.

In focusing on the one selected page, the teachers were asked how the objectives of the page might relate to benefits in Army life. The responses to this question are presented in Table A-3. Several different benefits to the soldiers were identified; these benefits focused on cognitive skills

useful in the Army and in everyday life. While one teacher identified three benefits, three of the nine teachers believed either that the cognitive skills were not applicable to Army life or that the soldiers would not apply these skills when needed.

A final potential benefit of the training involved the development of the teachers' ability to recognize students having difficulty with the instruments. Thus, they were asked how they would identify such students. The responses reflected the typical indicators used by teachers in most classroom situations, with or without IE--for example, incorrect answers and erasures, students' inability to give instructions or reasoning in their own words, speed of responses, and facial expressions. Only one indicator--precision of contributions to later subject-matter discussions--appeared directly related to IE. With IE material there may be other important indicators, such as students who fail to bridge or to apply the cognitive skills in nonclassroom situations.

Options for improvement of training. The teachers were questioned regarding their suggestions concerning the IE training. The two questions and the teachers' responses are shown in Table A-4.

The most frequently mentioned suggestions concerned the scheduling and organization of the training sessions. A second set of recommendations focused on adaptations of the IE materials and training for the Army. Here, the most frequently mentioned suggestion concerned the problem of the limited course time available. A third set of recommendations concerned other topics

related to the IE materials and training. The two most frequently mentioned items were the observation of classroom teaching and bridging into the subject matter.

Finally, after selecting one page of one instrument, the teachers were asked about the adequacy of the training and about their expectations of problems on this page. The comments appear in Table A-5. Problem areas that could be remedied in future teacher training were helping teachers with bridging, providing a teacher's guide or summary for Instructions, and helping teachers to assist students in working through the problems.

Recommendations for IE teacher training. The following recommendations are based on the initial training alone. The teacher trainers were advised by the research staff to attend to some of the problems during the implementation; therefore, some of the concerns disappeared. New concerns arose, however, as the teachers gained greater experience with the materials. In any case, if other Army BSEP teachers or teachers in other Army training programs receive IE training, the trainers should carefully consider the various suggestions regarding problem areas offered by the demonstration teachers as presented in Tables A-4 and A-5. In particular, further efforts may be needed in adapting the instruments for BSEP--both for the adult soldiers and for the limited time periods available.

With regard to the organization of the training, the trainer should consider reducing the time spent on Organization of Dots and increasing that spent on other instruments, reducing time spent on discussion of high points and low points, starting and ending sessons on time, and including definite break periods. While the scheduling of training sessions will depend upon the

preferences of the teachers at the selected sites, during vacation breaks or during afternoons when teachers are not needed in the classrooms are most desirable.

An important component of the teacher training involves classroom observations and critiques of the BSEP teachers by the teacher trainers. During these sessions, the trainers should assist teachers in such problem areas as bridging to the subject matter, using the cognitive map with students, assisting them in working through the problems, identifying and assisting students having problems and particularly in bridging, and assisting students in applying IE skills outside the classroom. The trainers should also include instruction and discussion time with the entire group of teachers on the topics already noted and also on identifying the need for Orientation in Space I, identifying the concrete benefits to the soldiers of learning IE, and helping the soldiers apply these skills.

Furthermore, attention must be focused on providing a serious answer to the teachers' questions about the limited time available in BSEP for the IE instruction. The basic issue of concern here involves the amount of transfer to soldiering skills that can be expected from a shortened version of the IE program. In other words, which of the following will produce the most transfer--brief coverage of most or all of the instruments, or in depth coverage of only a few of the instruments? While time constraints may be less problematic in other training settings, if further development of IE for BSEP is undertaken, attention should be directed to this issue.

Finally, the trainers must carefully consider whether or not they should devote effort to solving other problems--that is, providing a summary or guide for the Instructions instrument, providing some instruction or summary for all of the instruments, revising and adapting the materials even further for the

short time period available in BSEP, revising and adapting the materials even further for adults, providing the teachers with a method for deciding which students need IE the most, and including other trainers who have used IE with adult students.

The decision to devote effort to any or all of the above options will probably depend upon cost-effectiveness.

Observation of the Implementation of IE

Three sets of measures are included--observations of classroom activities, student performance on IE exercises, and interviews with teachers.

Observations of classroom activities. The IE program calls for intensive and highly structured efforts by classroom teachers. Feuerstein (1980) notes that the materials "are disseminated only to teachers who have received training" (p. 410). The proper use of the materials is essential to the success of the program. Therefore, as a measure of the effectiveness of the training received by the teachers and as a predictor of the student gains to be expected, researchers observed classroom instruction in each IE BSEP cycle at Fort Knox. (See Appendix E for a copy of the Classroom Observation Form.)

One IE BSEP class was observed for each teacher for each of four cycles during the thirty to thirty-five days of class each cycle. Observations of classroom activities focused on the amount and distribution of time for IE activities, the mechanics of IE activities, and the occurrence of events related to IE-targeted skills. Class sizes ranged from eight to 19 for classes taught by Teams 1 and 2, with means of 13 and 14 respectively. In Team 3, two teachers had class sizes of approximately six, while the third had classes of about twenty soldiers.

One group, which was exposed to the most extensive IE treatment, was designated as the "primary analysis group;" its gain scores were considered most meaningful. Initially, the students in these classes were to be exposed to IE materials during the 16-week period from January through April 1982. During the first eight weeks they were taught by Team 1; after that they were taught by Team 2. As pointed out earlier, Team 3 teachers stopped teaching IE after December 1981. Early in the implementation, one of the teachers in Team 1 refused to teach the IE pages but continued to discuss bridges from IE to Army or to academic subject matter. Later in the implementation, one of the teachers in Team 2 also refused to teach IE. At the end only four of the nine teachers were using the IE materials.

As shown in Table A-6, the average number of IE pages to which students were exposed in an instructional day by teachers in Team 1 and Team 2 was approximately five. For teachers in Team 3, who dropped out of the IE treatment, the average was lower. If this average were representative of the entire BSEP cycle, all pages of the selected instruments would have been covered. Teacher comments, however, indicated that the level of IE activity observed was more typical of a total for the week and in one or two instances amounted to as much as half the coverage for the total cycle. Informal observations of teachers' records of pages covered indicated that, if measured in terms of numbers of pages handed out, Teams 1 and 2 adequately implemented IE during the November-December cycle, and Team 1 also did in the January-February cycle. Therefore, the primary analysis student group, taught by Team 1 during January and February, was exposed to adequate numbers of pages in the first-level instruments (Organization of Dots, Orientation in Space I, Comparisons, and part of Analytic Perception), but probably not in the

second-level instruments (the remainder of Analytic Perception, Illustrations, Instructions, Numerical Progression, and Orientation in Space III).

Exposure in terms of total time reveals a similar picture, as shown in Table A-7. In the classes of Teams 1 and 2 observed prior to April, between one-quarter and one-half of the entire BSEP instruction time was based on IE materials. The April observations of Team 2 revealed a drastic decline in IE use. However, as pointed out earlier, these may not have represented typical days.

The number of minutes per page implied by the data presented in Tables A-6 and A-7 ranged from 12 to 31. Exceptions were for Team 1 in October, 46 minutes per page; Team 2 in April, four minutes per page; and Team 3 in December, eight minutes per page. The number of minutes per page is an important statistic because each page was intended by Feuerstein as the basis for a complete lesson, with opportunity for group discussion, discovery of strategies, instruction in cognitive concepts, development of vocabulary, self-analysis of performance, and generalization of skills to external situations. Thus, with the exception of Team 1 in October, no teaching team spent the specified amount of time per page on the average. Although there were a few individual instances in which a teacher spent over 45 minutes on a page, these were rare. The teachers expressed substantial alarm that allocation of the specified time to IE would deprive the soldiers of the ASVAB and GED preparation which they expected.

While the materials distributed and demonstrated by the teacher trainers indicated that one page per fifty minute lesson was appropriate, the initial schedule prepared by these trainers recommended that the BSEP classes cover a total of 192 pages in roughly eighty classroom hours--an average of 2.2 pages

per hour. As will be discussed in a later section, the original schedule was perceived as unrealistic and was modified prior to the January cycle. Nevertheless, the teachers felt some pressure to cover as many pages as possible in each period in which they used the IE instruments.

According to the training received by the teachers, the time spent on each IE page should be divided into Introduction, Independent Work, Discussion, and Summary. The Introduction, approximately 20% of the lesson, sets up the context for the exercises; the Independent Work, approximately 50%, develops student independence and self-confidence; the Discussion, approximately 20%, identifies the concepts involved in the exercises and helps the students to internalize them; and the Summary, approximately 10%, provides a vehicle for later recall of the skills learned.

According to the figures in Table A-8, the time allocation during the October, November, and December observations was generally balanced, although only about one-third as much time was spent by Team 1 teachers on Discussion and Summary as is considered appropriate. The time allocation deteriorated in the classes observed in February and April, however, when most of the time devoted to IE was spent on Individual Work.

Among the four activity categories, Independent Work is the easiest for a teacher to manage, because of the paper-and-pencil exercises provided by Feuerstein. Discussion is the hardest, because the teacher must subtly guide the topics toward discovery of cognitive strategies and spontaneously generate appropriate "bridges" between the IE exercises and "real world" problem solving. Thus, the imbalances observed are indicative of less than complete teacher training and indoctrination.

The effectiveness of an IE program also depends on what is done during the time allocated to each of the four phases. Particular activities were

suggested in training for each phase of the IE lesson, and the frequency of each of these activities was recorded.

The objectives of the Introduction to each lesson are to define tasks, problems, and objectives, and to arouse interest and motivation. Through questioning, the teacher assists students to focus on the problem and to discover the instructions. This questioning and discussion provides the background for and establishes the purpose of the lesson. The teacher's materials recommended that about ten minutes out of a fifty minute class be devoted to the introduction. Some form of introduction to pages was given in 25 of the 35 classes observed. The teacher trainers recommended half a dozen questions, which were included in supplementary materials discussing preparation of the class lessons. The data indicated that the teachers used these questions only infrequently. Each question was used in only about half of the introductions observed, except for error checking, which was rarely addressed.

Time for Independent Work was provided in 25 of the 35 classes observed. The data indicate that the teachers nearly always observed students' work and offered individualized assistance. Instances of reinforcing successful mastery and initiating discussion of problems with individual students or several students together occurred less frequently.

The Discussion section should take place for about ten minutes when most students have completed their individual work. The students should explore alternative strategies, identify the most appropriate strategy, analyze any difficulties, review the vocabulary, concepts, and operations that were used, and bridge to daily-life experiences and to academic subjects. While the teacher materials recommended questions for the teachers to ask to stimulate the discussions, those that did occur rarely went beyond the concrete IE page

to include a bridge to real-life problem-solving. As a result, many students as well as teachers referred to IE in terms of the content of the exercises--for example, "we did dots today." It should be noted that one of the three teachers in Team 1 taught no IE pages, but she did devote some classroom time to bridging from IE to Army experiences and to academic subject matter. The Discussion period was also to include some review of vocabulary items. The average was approximately one word per class period, except in April when there were none. With a few exceptions, the Discussion periods generally failed to meet the criterion of adequate implementation.

The Summary should include a restatement of the lesson's objectives. The ideal IE lesson concludes with about five minutes out of a fifty minute period. When included, the Summary was of reasonable length, approximately 7% of the total IE time. However, the data indicate that this component occurred in only 7 of the 35 classes observed.

In addition to recording information about time and frequency of lesson activities occurring in the IE classes, instances of or emphasis given to certain cognitive skills were also observed. Each lesson is more likely to teach cognitive skills if the teacher emphasizes them. Otherwise, the students' only exposure to the skills is in using them on the exercises. Ideally, each class should cover each skill. Skills included in the classes observed are shown in Table A-9.

Although teachers had indicated concern about how to "bridge" between IE and real-world problem solving, they did include this skill in their IE presentations in 70% of the classes. They also discussed the concepts of strategy and planning and emphasized the vocabulary of problem-solving and cognition in more than half the classes, and they frequently pointed out the

importance of careful, analytic perception and self-checking for accuracy. They tended to cover the other cognitive skills only sporadically, or only in lessons dealing specifically with those skills. The teacher who used no IE pages per se, but who taught with two team members who did, was observed to cover the cognitive skills listed at least as well as any other teacher.

The cognitive skills that Feuerstein focused on are an important contribution to remedial education, and a major outcome of IE teacher training is to familiarize teachers with these skills. The overall average of the percentage of classes in which each skill was emphasized decreased from 45% in October through February to 17% in April.

Finally, the general level of student classroom interest in IE was rated on a scale of from 1 to 5--definitely uninterested, somewhat uninterested, mildly interested, interested, very interested. The distributions of classroom ratings are shown in Table A-10. Evidence that students were "somewhat uninterested" included making fun of the materials and good-natured complaints about wasting time; evidence that students were "definitely uninterested" included open disregard for the exercises by some students, with serious, strong negative comments. Evidence that students were "very interested" was the active discussion and rich flow of ideas about cognitive skills, which the IE teacher-trainer demonstrated as the model of an ideal IE class.

There was substantial variation in implementation between teachers. However, for main-line BSEP students taught by Teams 1 and 2, all were exposed to a variety of levels of implementation. In terms of the overall mechanics and content of the IE implementation, there were two general findings. First, the IE materials were being used in classes. However, the classes observed may not have been representative of the entire BSEP cycle, and, in any case,

usage decreased greatly during the final eight week period. Second, although the Introduction and Independent Work phases of lessons were implemented well and "bridging," strategies, and problem-solving vocabulary were mentioned, with few exceptions the Discussion and Summary phases were generally too brief and superficial to be effective.

Thus, two reasons for expecting negative results from student gain analyses that would not necessarily generalize to other demonstrations were identified. First, the primary analysis group was exposed to IE during the period of declining implementation, January to April. Second, if the Discussion and Summary phases of the lesson are essential for student gains, then the effectiveness of IE may have been substantially weakened.

Student performance on IE exercises. Performance on IE materials completed in class provides a measure of the student performance level as well as an indication of the effectiveness of training. If all or most students complete certain pages without error, then the students may have already acquired the cognitive skills needed for the exercises. Assuming that cognitive deficiencies exist among these students, then the performance level, particularly on early pages in an instrument, should be fairly low. If the training is effective, and the exercises do not increase dramatically in difficulty, then student performance ought to improve with later pages in the same instrument.

The pages analyzed were selected because most of the students had worked on them. During the January-February cycle, pages from Organization of Dots, Orientation in Space, and Comparisons were received from students in classes

taught by Team 1. During the March-April cycles, only pages from Organization of Dots were received. Therefore, only two of the ten pages examined could be compared for the two time cycles and student groups.

The results of students' work on the selected pages is presented in Table A-11. It should be remembered that the IE materials--and, hopefully, the classroom Discussion--stress the importance of planning and precision in attacking and solving problems. Control over impulsive responding is expected to lead to elimination of the need to erase and revise responses. Thus, examination of completed IE materials considered both errors and erasures as indications that students had experienced some difficulty with the materials.

The data from Organization of Dots for the January-February cycle indicated that these IE problems were difficult for the soldiers; only one person in the class made no errors or erasures. There appeared to be some improvement over time--for example, the percentage without errors improved from 7% to 46%. This conclusion is very tentative, however, because the pages are neither equated for difficulty not uniformly increasing in difficulty. Data from the March-April cycle also indicated that the problems presented in Organization of Dots posed some difficulties.

The problems in Orientation in Space I appeared to be somewhat easier for the soldiers, although nearly half of the class made some error or erasure. A somewhat similar pattern emerged from the data on Orientation in Space with an improvement in performance from the earlier to the later page--56% had no errors on page six, and 90% had no errors on page 13. The deterioration in performance on page 12, with a large number of errors and erasures, may have been due to a format change--starting with page 12, the problems become abstract, symbolic representations, as opposed to drawings of individuals.

The deterioration in performance on the pages from Comparisons appeared to be related to the increased complexity of the problems on the later page--44% had no errors on page three, but only 12% had no errors on page nine.

This analysis of student performance on the IE exercises thus revealed that the exercises were not easy for the soldiers and that they experienced some difficulties, but it also provided tentative evidence of improvement in performance.

Interviews with teachers. The teachers were the essential mediators in this IE implementation, and they had very strong ideas about the implementation and the needs of teacher training. They also had firsthand estimates of student gains in cognitive skills. Researchers therefore conducted interviews following the classroom observations. The answers to three questions suggest changes that might be made, either in the teacher training or in the IE materials for future implementations with similar groups. The answers to a fourth question provide some non-test data to supplement tests of student gains.

Teachers' positive open-ended comments about the program are shown in Table A-12. The comments were grouped according to effects on students, effects on classroom teaching, and training and materials. Thirty-one positive comments were made in 34 interviews. Most frequently mentioned were that IE generated discussion and interest, IE concepts and theory such as teaching strategies and logical reasoning are good, and students liked IE. There was no spontaneous consensus, however, on any single positive contribution of IE.

Negative open-ended comments are shown in Table A-13. Because they suggest directions for improving the IE implementation, negative comments can be more helpful than positive comments. The comments were grouped according to student reactions, effects on students, teaching and classroom problems, and training and materials. There were 44 negative comments in 34 interviews. Only two comments appeared frequently--students don't like IE, don't want to be "bothered" with it, and refuse to do it; and lack of time is a problem.

Student dislike of IE appeared to be related to immediate concern with raising GT and GED scores, the perceived childish look of the instruments, and the repetition included in certain instruments. The comment concerning lack of time is a function of two specific characteristics of this program implementation. IE, originally designed for a two-year period, was condensed into one or two six-or eight-week cycles, and, since the bottom line measure of the teachers' success was the level of student gains on the GT and GED tests, they felt that their primary responsibility was to concentrate on subject matter instruction. This problem was exacerbated by the difficulties that teachers encountered in bridging between IE and their regular subject matter.

Teachers' recommendations for modifications in the IE program are shown in Table A-14. Fourty-four recommendations were made in 34 interviews. With regard to training, the teachers expressed a need for more classroom observations by the teacher trainers and more feedback from them. The teacher's manual needed more practical ideas, including ways to bridge to subject matter and to the Army. In addition, it needed better editing to improve the organization and to correct the errors. Regarding instruments, a frequent comment was that they should have fewer pages. This was probably

related to the teachers' concerns about the lack of time and the students' reactions to the repetition. Teachers also recommended that the instruments be modified for use by adults, particularly Orientation in Space I and Illustrations. And regarding implementation, teachers felt that a longer period of time was needed. They indicated that it would be better to present IE in basic training, BSEP I, or junior high school, where the focus is on prerequisite skills and more time might be devoted to IE.

However, regardless of their misgivings about the IE adapation used, the teachers did report observing positive trends in the development of cognitive skills by some of their students. Specific changes in student behavior observed by teachers in Teams 1 and 2 are presented in Table A-15. Because the October and November interviews were conducted too early in the BSEP cycle--and in the IE implementation within that cycle--for gains to have been reliably observed, data were collected in only 17 interviews beginning in December. The most frequently mentioned changes were increased participation in oral discussion (n=14), improved use of vocabulary and concepts taught in class (n=14), and improved ability to follow directions (n=3). Of those behavioral changes covered in the interview form the change noted least frequently was increased relevance and completeness of answers.

The differences in frequency regarding behavioral changes should be interpreted with caution, however; they may be a function of teachers' ability to report behaviors according to the researchers' categories rather than a function of the actual occurrence of the behaviors. Furthermore, there is uncertainty concerning cause-effect relations between IE implementation and the observation of gains on these skills. To provide useful data and to guard against superficial positive responses to questions about student gains, the

teachers were asked to identify one or more specific students whose gains were notable whenever gains in the class were reported.

In general, it appeared that most of the teachers took the IE implementation seriously and hoped that it would be helpful. Their identification of difficulties and recommendations for change should be carefully considered in any future adaptation of IE for use with an adult population in a limited time period.

Measurement of Student Gains

Both standard and newly developed paper and pencil tests were adiministered to measure student gains. There was no control group in the design of this IE demonstration, although the data were compared with data from a BSEP cycle a year earlier. This comparison, however, proved difficult. The criterion test used in the 1980 cycle was the ABLE rather than the TABE and, although the pre-post GT gains were similar for both cycles, peculiarities were found in the pre-GT scores as described below. The general conclusion reached was that the gains for the two cohorts were about the same and that they were both significant.

The evaluation of impact is limited to the three cycles of soldiers in the 14- or 16-week BSEP cycles starting in November 1981, January 1982, and March 1982. Except for students taught by Team 1 in the January cycle, all before-after test comparisons are for the first six or eight weeks of BSEP training. Therefore, the primary analysis group is the set of students who started in January with Team 1 and continued through April, a total of 16 weeks.

It is possible to reach some conclusions about the contribution of IE to learning, even with the short time spans for the cycles. Standard ASVAB GT

scores and TABE scores were obtained by the BSEP staff, and scores were also obtained on two newly developed cognitive tests. The test made up of pages extracted from IE materials is included in Appendix C, and the test of Cognitive Skills which IE is intended to foster is included in Appendix D. These tests include the following subtests:

- o IE Test
  - o Comparisons
  - o Illustrations
  - o Instructions
  - o Orientation in Space III
  - o Analytic Perception
  - o Orientation in Space I
  - o Numerical Progression
  - o Categorization
  - o Organization of Dots
- o Cognitive Skills Test
  - o Map Reading
  - o Identification of Problem Dimensions
  - o Ordering
  - o Use of Common Objects
  - o Cognitive Vocabulary
  - o Generation of Problem Solutions

- TABE

  - Reading Vocabulary
  - Reading Comprehension
  - Reading Total
  - Math Computation
  - Math Concepts and Problems
  - Math Total
  - Language Mechanics and Expression
  - Spelling.

It was hypothesized that, if the IE lessons were having any effect, gains would be apparent on the IE Test. If these gains generalized to the cognitive skill domains, then scores on the two tests should be correlated, and there should be gains on the Cognitive Skills Test. If either IE Test gains or Cognitive Skills Test gains transfered to TABE and GT scores, then scores on TABE and GT should be correlated with scores on the IE Test or the Cognitive Skills Test, and there should be gains on TABE and GT.

Finding gains on TABE and GT that were unrelated to IE or Cognitive Skills is possible, of course, either because gains in the IE or Cognitive Skills were not needed for TABE and GT gains or because the IE Test and the Cognitive Skills Test, which were newly developed and quite short, failed to detect the IE or Cognitive Skills gains.

The correlations among the three measures used to determine gains can be examined to determine the degree of correspondence. While these data, as shown in Table A-16, can suggest links between IE gains and other test score gains, they cannot be translated into causal relationships. Correlations

between Ordering and both Categorizations and Orientation in Space III were significant for both the pretest and the posttest. The only other consistent correlations between the subtests were between Analytic Perception and Map Reading and, negatively between Orientation in Space III and Uses of Common Objects. It should be noted that the large gains on Organization of Dots exercises did not generalize to the Cognitive Skills subtests.

In interpreting these analyses, it is useful to know the reliabilities of the tests While separate reliability data were not collected, pretest-posttest correlations were calculated. These correlations, shown in Table A-17, are probably slight underestimates of the reliabilities in most cases--≃20%. The pretest-posttest correlations ranged from .20 to .62 for the IE Test and from .34 to.79 for the Cognitive Skills Test. For a definitive study, it would have been preferable to have had a more extensive battery than this one-hour coverage of 15 subtests. However, these correlations are generally comparable to those for the TABE, which ranged from .51 to .76.

The pretest-posttest correlation for the GT composite of the ASVAB was surprisingly low--.32. This led to further examination of the GT tests, as shown in Table A-18. While there were reasonable correlations between the GT and the TABE scores for the posttest--from .28 to.79--the pretest GT scores were virtually uncorrelated with the TABE scores, with correlations ranging from -.05 to .28. In fact, the pretest TABE scores are much more closely correlated with post-GT scores than with pre-GT scores. Although explanation for this finding is beyond the scope of this study, one possibility is that the value of GT scores obtained by these soldiers on entry to the service may be questionable.

BSEP students achieved gains on all of the TABE subtests--in effect, six or eight weeks of BSEP was equivalvent to nearly a year of schooling. The largest gains were in Math Computation and Language Mechanics and Expression. These gains were generally much more substantial than could be accounted for by gains on either the IE Test or the Cognitive Skills Test. The significant and consistent correlations are shown in Table A-19 for the IE Test and Table A-20 for the Cognitive Skills Test. The only relation to Reading scores was the correlation between Use of Common Objects and Reading Total; the only scores significantly correlated with Language Mechanics and Expression were Orientation in Space III and Map Reading; and no variables were significantly correlated with Spelling. Math Concepts and Problems was significantly correlated with only Numerical Progression.

Generally, there was a significant correlation between the total TABE battery score and the Cognitive Skills Test (r=.37). There was also a significant posttest correlation between the total TABE battery score and the IE Test (r=.44), which did not occur for the pretest (r=.17). This is consonant with the hypothesis that the IE Test scores were more meaningful after instruction than before, which might be due to the paucity of instructions given with the exercises. The correlation of the IE Test and Cognitive Skills Test scores with GT could only be measured at the time of posttest, as noted above. There were significant correlations with Comparisons, Orientation in Space III, and Categorizations, and with Ordering and Use of Common Objects.

Finally, the primary analysis group was followed through a 16-week, two-cycle BSEP program; the results are summarized in Table A-21. The results indicated that, although gains occurred during the first eight weeks, no additional gains occurred as a result of the extra eight weeks of

instruction. One explanation is that a ceiling had been reached on the amount of knowledge that could be assimilated by the soldiers from continuous BSEP attendance. An alternative explanation is that the teachers may not have been as attentive during what was the final period of their unrenewed contract. This alternative explanation is not substantiated, however, both because the teachers were observed to be continuing their instruction responsibly, and because TABE gains continued to be shown for other soldiers during this period.

In summary, the gains that occurred on the TABE were not clearly related to gains on the Cognitive Skills Test, nor were the substantial gains on the IE Organization of Dots subtest correlated with other gains. There were a few suggestive correlations but, in general, the objectives as represented by short range gains on the TABE appear to be unrelated to short range Cognitive Skills Test gains. It may be necessary to make a choice between these two objectives in planning for future implementations of Feuerstein's Instrumental Enrichment in BSEP. In any case, the IE program was designed to produce long term--not short term--gains, and a thorough evaluation will require the follow up of both the participating soldiers and a control group for at least a year.

DISCUSSION

The process and results of an adaptation of Feuerstein's IE program for use in BSEP II was examined from August 1981 to April 1982. In addition to determining whether IE training leads to gains in cognitive functions, the links between IE program inputs and various test score gains were analyzed and the needs for improvement in future adaptations of IE for Army use were identified. Special emphasis was given to evaluation of the teacher training and implementation process. The evaluation was based on a model of the demonstration, including the categories of factors that might affect the improvement of soldiers' performance--teacher preparation, classroom time and other resources, adequacy of the IE materials, and teacher and student motivation. In the context of the limited time of the present demonstration, only a partial investigation of the model was possible.

Teacher Preparation

Several indicators pointed to the fact that training for teaching IE was inadequate. For example, at the end of training, only six of the nine teachers were able to identify in an IE exercise the cognitive functions important for soldiers. The teachers themselves acknowledged inadequacies in the training by suggesting that the training needed more feedback on attempts to use IE in classroom teaching or more demonstrations of teaching, introduction of better methods for bridging between IE exercises and academic subject matter, and better organization of the training. Later in the implementation, these inadequacies in teacher training were evident in the

actual teaching--limited time was devoted to the Introduction and the Discussion of IE exercises, a Summary was lacking at the end of the IE lessons, and there was limited inclusion of cognitive functions in class lessons.

Classroom Time and Other Resources

Because of the restrictions of the original BSEP training cycle, the time available for full implementation of the IE program was inadequate. The original training cycle included 17.5 class hours a week for 12 weeks for a total of 210 class hours per cycle, and, assuming one hour per page presented in class, the original schedule for the IE implementation required 176 class hours. Given the additional need to cover language, reading, and math skills in BSEP, these schedules were incompatible. During the demonstration, the BSEP cycles were increased to 14 weeks and then to 16 weeks, finally totaling 280 hours of classroom instruction. This would have been adequate if there had not also been the concurrent goal of improving language, reading, and math scores. To deal with the competing objectives, teachers reduced the number of IE instruments, reduced the number of pages in each IE instrument, and reduced the time spent on each IE page. Each of these changes contributed to a generally inadequate IE program implementation.

Adequacy of IE Materials

According to the teachers, the IE materials required major improvements. The teacher's manual needed more practical ideas, better editing and organization, and better guides to bridging between IE exercises and academic subject matter and Army tasks.

The IE instruments, originally designed for adolescents, needed to be revised for use with an adult population. For use in the limited time available to the BSEP program, a narrower focus on cognitive skills is needed with selections from among the instruments and from among pages within the instruments.

Teacher and Student Motivation

Teachers were in general agreement with the goals of the IE program, although in the limited time available they felt a conflict with the needs of the soldiers for instruction in reading, language arts, computation, and science. During the final stages of the demonstration the program was disrupted by the award of the next BSEP teaching contract to a new firm, thus bringing the teachers' jobs into jeopardy.

The students appeared to be mildly interested in the IE exercises. Their main motivation and reason for participating in BSEP was to improve their GT scores or to acquire General Educational Development (GED). When teachers conveyed a sense that the IE materials would help them in their pursuits, students responded positively to IE. However, only five of the 15 Cognitive Skills subtests and IE subtests actually correlated with GT scores at the time of the posttest:

IE Categorization	r=.73
IE Orientation in Space III	r=.62
IE Comparisons	r=.44
Cognitive Skills Use of Common Objects	r=.53
Cognitive Skills Ordering	r=.49.

Thus, soldiers who felt that the IE work would not help them in the short term in their pursuit of higher GT scores may have been justified in their

belief. This result cannot generalize to longer term effects, however, without a longer term demonstration.

Student Gains in Cognitive Functions

Gains in cognitive functions were assessed using a test designed by the research staff, together with selected sections of the IE instruments. Only five of the 15 tested skills showed significant gains from the pretest to the posttest:

IE	Organization of Dots	$t=5.46$, $df=34$, $p<.002$
IE	Categorization	$t=3.02$, $df=34$, $p<.02$
IE	Orientation in Space I	$t=2.72$, $df=34$, $p<.05$
IE	Orientation in Space III	$t=2.52$, $df=34$, $p<.05$
	Cognitive Skills Ordering	$t=2.20$, $df=36$, $p<.05$.

Some generalization of IE gains is indicated by the fact that posttest scores on Ordering were correlated with both Categorization ($r=.39$) and Orientation in Space III ($r=.35$). On the other hand, the largest gains appeared in Organization of Dots, but these gains did not generalize to any of the Cognitive Skills subtests or to the course criterion test, the TABE.

Student Gains in Skills Tested

Significant gains similar to those obtained in a prior BSEP cycle not employing IE occurred on all six TABE subtests--reading vocabulary, reading comprehension, math computation, math concepts and problems, language mechanics and expression, and spelling. The students showed gains of approximately one year of schooling as a result of six or eight weeks of BSEP. Because the variables were not highly correlated, these gains, which are

similar to gains at other BSEP installations, were more substantial than could be accounted for by gains on the IE and Cognitive Skills Tests.

SUMMARY

The main finding of the evaluation is that the demonstration of the adapted Feuerstein IE program undertaken as part of the Fort Knox BSEP II program was an inadequate implementation. On the basis of this tryout, it is impossible to reach any valid conclusion about the potential value of IE in the Army. A critical factor affecting the implementation was termination of the teachers' contract in the middle of the demonstration. Other factors also led to a poor implementation--insufficient class time was allocated for implementing a two-year program within the context of the six or eight week BSEP cycle; the IE materials were not appropriately adapted for Army use in BSEP, as indicated by the disparaging comments of both teachers and students; teachers were inadequately prepared, as revealed in failures to use specified techniques; and, because of problems with classroom time and with teacher and student motivation, students failed to work through all of the problems.

There were a few significant gains in student performance as a result of the IE implementation. Significant pretest-posttest gains were observed in selected sections of four IE instruments--Organization of Dots, Categorization, Orientation in Space I, and Orientation in Space III--and in one component of the Cognitive Skills Test--Ordering. The posttest scores on Ordering were also correlated with both Categorization and Orientation in Space III. Furthermore, posttest GT scores were correlated with IE subtests in Categorization, Orientation in Space III, and Comparisons, and with the Cognitive Skills Test subtests in Use of Common Objects and Ordering. Although significant gains appeared on all subtests of the TABE, these gains

were similar to those in previous BSEP cycles that did not employ IE, and they were not correlated with gains on either the IE Test or the Cognitive Skills Test.

RECOMMENDATIONS

Given the problems experienced in attempting to demonstrate IE within the context of BSEP II--short class cycles, contract teachers with minimal training in the subject matter, contract teachers with a probability of being replaced by the lowest contract bidder--a demonstration of IE in the Army may be best undertaken within another training program. If IE were to be implemented in BSEP II, major modifications would need to be undertaken in the design of the IE program and the BSEP program. Modifications are needed in teacher training and in program objectives, content, and scheduling.

The teacher trainers should make special efforts to assist teachers in a number of areas--bridging to the subject matter; using the cognitive map with students; assisting students in working through the problems; identifying students having problems, particularly in bridging; assisting students in applying IE skills outside the classroom; and identifying the concrete benefits of learning IE.

In addition to greater emphasis on certain topics in IE, several options should be considered for the organization and scheduling of the training: including teacher trainers who have used IE with adult students; starting and ending the training sessions on time and including definite break periods; and conducting the training session during vacation breaks when teachers are not needed in the classrooms.

Several options were suggested by teachers for modification of the IE instruments and training manuals: revising and adapting the materials for the short time period available in BSEP; revising and adapting the materials for adults; providing the teachers with a method for deciding which students need IE the most; developing a summary or guide for the instructions instrument; and providing some summary of all the instruments.

All of these recommendations should be considered in any future implementation of IE in BSEP or in other parts of Army training.

Any future implementation of IE within the Army should also be accompanied by an evaluation of both the impelmentation and the long term outcome. As a result of the present demonstration, a variety of procedures have been identified that may be used in such an evaluation for examining the implementation as well as the outcomes of the program. These procedures include assessing teacher training, conducting classroom observations, gathering records on student performance on IE materials, and gathering pre- and post-measures of soldier performance. A complete evaluation should include a longitudinal assessment of soldiers' performance, since the greatest impact of the Feuerstein IE program is not expected until several years after its conclusion.

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APPENDIX

Tables

Table A-1

Description of Data Collection Instruments

Measures	Data sources	Procedures developed
Prior to and following instruction		
Pre- and post-measures on soldiers		
Standardized tests		
GT (subset of ASVAB)	Soldier records	None
TABE	Soldier records	None
Test of cognitive functions	Soldiers	Development of tests (including adaptation of IE instruments)
Measures of teacher training		
Teacher trainer and supervisor assessment	Teacher trainers and teacher supervisor	Teacher preparation rating form
Teacher assessment	Teachers	Teacher reaction to IE
Adequacy of materials	Research staff	IE materials review
During instruction		
Record of exposure	Teacher records of instruction	None
	Teacher attendance records	None
Performance on IE materials	Completed IE forms	None
Self-evaluations	Teachers	Teachers evaluations of IE materials
Observer evaluations	Research staff	Teacher observation form

Table A-2

Teachers' Responses to Question, "What is the most important thing that you learned during the IE training sessions?"

Most important thing learned	Frequency (N=9)
New materials and methods	
New or different ways of teaching	3
Availability and use of IE instruments	2
Bridging (to everyday life and to Army life)	2
Ways of organizing instruction	1
Method for getting students to think and to talk about what they are doing	1
Method for getting students to talk about implicit versus explicit instructions	1
New concepts	
Flexibility of the mind	1
Learning left from right is a cognitive skill	1
Reinforcement	
Teaching style	1
BSEP students can be helped	1
Enthusiasm for teaching	

Table A-7

Teachers' Responses to Questions, "Do you think that the cognitive functions that this aims to elicit are important for the soldiers? What would be an indicator of gains, in Army life?"

Indicator	Frequency (N=9)
Benefits or gains	
Increased precision in giving instructions	1
Increased flexibility in wording of instructions	1
Increased awareness of and precision with written instructions	1
Ability to recognize new situations	1
Ability to adapt traditional methods to new situations	1
Decrease in egocentric behavior; ability to view problem from another's perspective	1
Ability to generate information	1
Ability to use points of reference	1
Ability to read maps	1
Lack of benefits or gains	
No application to Army life	2
Failure to apply skill	1

Table A-4

Teachers' Suggestions for Improving IE Training in Response to Questions, "If there had been more training time for IE, how should it have been used? If IE training were to be done for BSEP at another post, what changes, if any, would you recommend from the experience at Fort Knox?"

Suggestions	Frequency (N=9)
Scheduling and organization of training sessions	
Scheduling of training when teachers not needed in classrooms	5
During afternoon (used for tutoring) rather than during morning (used for classes)	
During vacation break	
Better organization of training	3
Better pacing of training	1
Less time with Organization of Dots and more time with later instruments	
Starting and ending sessions on time	1
Inclusion of scheduled break times	1
Reduction in time spent on "highs and lows"	1
More attention given to Army adaptation	
Answers given to questions about limited time	3
Instruction and practice given in all instruments (to provide broad foundation)	1
Revision and adaptation of materials for a shorter time period--6 or 12 weeks versus two years; reduce number of instruments presented to soldiers but cover them more thoroughly	1
Revision and adaptation of materials for adults--changing pictures of boys into soldiers is not enough	1
Trainers who have worked with adults	1
More attention or effort given to other IE materials and training topics	
Observation of classroom teaching or teaching demonstrations	5
Bridging to subject matter--break into subject-matter groups	4
Instruction in use of cognitive map with students	1
Method for deciding which students need IE the most	1
Other suggestions	
Have trainers speak more loudly	2
Present IE in positive light from beginning	1
Have afternoon bull session to discuss IE after two to three weeks of teaching	1
Include IE as part of Basic Training for everyone	1

Table A-5

Teachers' Responses to Questions, "Do you think the training was adequate for this exercies? What problems have occurred (or do you expect to occur) with it?"

Instrument	Page	Comment (N=9)
Organization of Dots	6,7	Training adequate; no problems
	4	Objective difficult to find in manual
	14	No bridging in manual
Orientation in Space I	12	Training adequate; no problems
Instructions	24	No teacher's guide for instrument; need a summary at least
	39	Students may not understand what to do with it
Numerical Progression	13	Students may not be able to apply formula
	35	Page not covered in training

Table A-6

Number of IE Pages Observed to be Presented in a Three-and-one-half-hour Instructional Day in 1981 and 1982 to Primary Analysis Group of Students

Teachers	Number of Pages				
	October (N=9)	November (N=8)	December (N=8)	February (N=5)	April (N=4)
Team 1 (n=3)	2	6	7	6	2
Team 2 (n=3)	6	5	3	2	3
Team 3 (n=3)	3	2	2	0	0

Table A-7

Amount of Time Observed to be Spent on IE Lessons in a Three-and-one-half-hour Instructional Day, and Time per Page, in 1981 and 1982

	Time in hours and minutes--total (page)				
Teachers	October (N=9)	November (N=8)	December (N=8)	February (N=5)	April (N=4)
Team 1 (n=3)	1:33 (0:47)	1:25 (0:14)	1:27 (0:12)	1:27 (0:15)	0:50 (0:25)
Team 2 (n=3)	1:21 (0:12)	1:39 (0.20)	1:18 (0:26)	1:02 (0:31)	0:11 (0:04)
Team 3 (n=3)	0:47 (0:16)	0:34 (0:17)	0:16 (0:08)	0:00 (0:00)	0:00 (0:00)

Table A-8

Percentage of Time Allocation Early and Late in Demonstration in 1981 and 1982

Teachers	Phase			
	Introduction	Independent work	Discussion	Summary
	October/November/December (N=25)			
Team 1 (n=3)	42	49	7	2
Team 2 (n=3)	33	37	28	2
Team 3 (n=3)	19	45	35	1
Weighted average	34	44	20	2
	February/April (N=9)			
Team 1 (n=3)	23	69	7	1
Team2 (n=3)	25	53	22	0
Team 3 (n=3)	0	0	0	0
Weighted average	23	62	12	1

Table A-9

Classroom Occurrences of Cognitive Skills

Cognitive skills	Frequency				
	October (N=9)	November (N=8)	December (N=8)	February (N=5)	April (N=4)
Bridging, generalization, transfer	7	7	4	5	1
Labeling, naming, vocabulary	6	6	3	4	2
Strategy, planning	5	6	4	3	3
Checking, accuracy, need for precision	4	5	4	3	0
Analytic perception, careful observation, searching for cues in data gathering	6	4	1	2	0
Perspectives	3	3	2	2	0
Evaluating alternatives, spontaneous comparison	4	2	1	0	0
Ordering of steps, sequencing	4	1	1	1	0
Reasoning, logic	2	2	1	2	0

Table A-10

Ratings of Observed Classes on General Level of Student Interest

Rating	Frequency					
	October	November	December	February	April	Total
Very interested (5)	1					1
Interested (4)	1	1	1	1	1	5
Mildly interested (3)	3[a]	5[a]	1	1	1	11[a]
Somewhat uninterested (2)		2	1[a]	2[a]	1[a]	6
Definitely uninterested (2)	2		1		1	4

[a]Median.

Table A-11

Soldier Performance on IE Exercises, in Percentages

Number of frames	Organization of Dots					Orientation in Space			Comparisons	
	Page 2 (n=14)	Page 5	Page 4 (n=19)	Page 6 (n=22)	Page 10	Page 6 (n=18)	Page 12 (n=22)	Page 13 (n=21)	Page 3 (n=16)	Page 9 (n=16)
January-February cycle										
With errors										
0	7.1		21.1	45.5		55.6	59.1	90.4	43.8	12.5
1 to 2	35.7		52.6	50.0		33.3	18.2	4.8	43.8	25.0
3 or more	68.2		26.3	4.5		11.1	22.7	4.8	12.4	62.5
With erasures										
0	0.0		15.8	13.6		61.1	31.8	57.1	87.5	43.8
1 to 2	21.4		10.5	40.9		33.3	27.2	23.8	12.5	43.8
3 or more	78.6		73.7	45.5		5.6	41.0	19.1	0.0	12.4
March-April cycle										
		(n=21)	(n=26)	(n=20)	(n=25)					
With errors										
0		90.5	38.5	80.0	64.0					
1 to 2		9.5	23.0	15.0	24.0					
3 or more		0.0	38.5	5.0	12.0					
With erasures										
0		66.7	7.7	25.0	4.0					
1 to 2		33.3	15.4	20.0	12.0					
3 or more		0.0	76.9	55.0	84.0					

Table A-12

Teachers' Positive Open Ended Comments Regarding IE Program

Comment	Frequency (N=9)
Effects of IE on students	
Students liked IE	3
Students enjoyed pinwheel game (OS1)	1
Students liked change from subject matter	1
Students liked idea of cognitive functions	1
Students became more precise in instructions and improved in communication skills	1
Students applied strategies on job	1
Effects of IE on classroom teaching	
Generated discussion and interest	5
Helps in teaching vocabulary	1
Helps in teaching strategies	1
Helps teaching inferences	1
Fits with subject matter	2
Helps "put it all together"	1
Is good for team teaching	1
Helps promote coordination among teachers	1
Trains teachers to teach thinking	1
Training and materials	
IE concepts and theory, such as teaching strategies and logical reasoning, are good	5
Teacher trainers provided good advice on certain instruments	1
Teacher's manual provides preparation in theory	1
Instruments are good	1

Table A-13

Teachers' Negative Open Ended Comments Regarding IE Program

Content	Frequency (N = 9)
Student reactions	
Students don't like IE; don't want to be "bothered" with it; refuse to do it	5
Students who need it most seem to resent it most; those who found it hard had negative comments	2
Students appear to be negative because of concern with GT and GED scores	1
Students appear to be negative because of "look" of instruments	1
Students are bored with it after novelty has worn off	1
Students reacted to IE as if it were "kid stuff"	1
Students don't like repetition of Analytic Perception	1
Students don't like Organization of Dots and Orientation in Space	1
Effects on students	
No student improvement was observed	1
Skill transfer was generally lacking	1
IE didn't seem to alleviate learning disability problems	1
Teaching and classroom problems	
Lack of time is problem	4
Leads to added homework	1
Leads to getting behind in subject matter	1
Transition between IE and subject matter always loses students	2
Bridging is difficult	1
Bridging to English is especially difficult	1
Bridging to Army is difficult	1
IE creates some inflexibility (in tying several classes together)	1
Time can be better spent on subject matter instruction	1
Training and materials	
Orientation in Space 1 is not needed for this group	2
Instruments are too long; have too many pages, especially Organization of Dots and Instructions	2
There appears to be no transfer to math, for example, from Organization of Dots	2
IE's emphasis on adult/child or leader/follower relationships poses problems for teaching adults	2
IE does not appear to be motivating to students	1
There is no good tie between instruments and cognitive functions	1
IE does not blend well with science curriculum	1
IE does not have anything on listening skills	1
Teacher's manual is poor	1
Training time was wasted in discussions of "highs and lows"	1
Teachers were confused with regard to what was required in program	1

Table A-14

IE Program Modifications Recommended by Teachers

Change	Frequency (N = 9)
Training	
Trainers should give more feedback on classroom observations	2
Clearly defined goals, definitions, instructions, and schedule needed	1
Trainers should observe classrooms more often	1
Teacher's manual	
More practical and good ideas needed	4
Better editing, including correction of errors, misinformation, typos, and organization, needed	3
More and better bridging to subject matter needed	3
Better bridging to Army, to MOSs, needed	1
Better sections on military needed	1
Instruments	
They should be shorter--have fewer pages, include only three or four pages per instrument	5
They need to be modified for adults	4
They look too elementary, especially Orientation in Space I and Illustrations	3
They need better organization	1
They should be reviewed by military staff to be made more Army-relevant	1
Orientation in Space I is not needed for this group	1
Orientation in Space III needs revisions	1
Implementation	
Longer period of time needed for program	6
It would be better to present IE in basic Training or ESP I or junior high school	5
It should be oriented toward individual diagnosis	1

Table A-15

Changes in Student Behavior Observed by Teachers in Teams 1 and 2

Change	Frequency
Increased participation in oral discussion	14
Improved use of vocabulary and concepts taught in class	14
Improved ability to follow directions	13
Improved ability to solve problems in class	12
Increased attention span and concentration on tasks	11
Improved ability to learn new tasks	10
Increased enthusiasm for learning	10
Increased responsibility for making up own work	10
Increased volunteering for additional learning or problem solving tasks	9
Increased checking of own work	9
Increased relevance and completeness of answers	7

Table A-10

Correlations of IE Test and Cognitive Skills Test Scores (N pretest=55, N posttest=35)

IE Subtests	Cognitive Skills tests--pretest, posttest[a]						
	Map Reading	Identification of Problem Dimensions	Ordering	Use of Common Objects	Cognitive Vocabulary	Generation of Problem Solutions	Average for Cognitive Skills Test
Comparisons							
Illustrations							
Instructions			.33,.35	-.31,-.36			
Orientation in Space III							
Analytic Perception	.45,.36						
Orientation in Space I							
Numerical Progression							.38,.39
Categorizations			.37,.39				
Organization of Data							
Total IE battery score	.36,.45		.29,.53				

[a]Both pretest and posttest correlations are > 2 SDs different from 0.

Table A-17

Pre-Post Correlations of Cognitive Skills, IE, TABE, and GT Test Scores

Test	Correlation
Cognitive Skills	
Map Reading	.41
Identification of Problem Dimensions	.55
Ordering	.79
Use of Common Objects	.58
Cognitive Vocabulary	.55
Generation of Problem Solutions	.34
Total Cognitive Battery	.56
IE	
Comparisons	.40
Illustrations	--
Instructions	.56
Orientation in Space III	.62
Analytic Perception	.29
Orientation in Space I	.25
Numerical Progression	.43
Categorization	.20
Organization of Dots	.29
Total IE Battery	.59
TABE	
Reading Vocabulary	.65
Reading Comprehension	.59
Reading Total	.67
Math Computation	.76
Math Concepts and Problems	.67
Math Total	.66
Language Mechancis and Expression	.57
Spelling	.76
Total TABE Battery	.67
GT	
GT	.32

Table A-18

Correlations of TABE and GT Scores

Test	Correlation		
	Pre-GT (n=89)	Post-GT (n=84)	(Post-GT with Pre-TABE)
Reading Vocabulary	.22	.46	.44
Reading Comprehension	.23	.59	.31
Reading Total	.28	.59	.45
Math Computation	-.05	.70	.62
Math Concepts and Problems	.09	.79	.52
Math Total	.07	.76	.61
Language Mechanics and Expression	.16	.28	.06
Spelling	.15	.30	.42
Total TABE battery score	.17	.69	.54

Table A-19

Correlations of IE Test with TABE and CT Scores (N pretest=55, N posttest=35)

IE tests	TABE--pretest, posttest[a]									CT--posttest only
	Reading Vocabulary	Reading Comprehension	Reading Total	Math Computation	Math Concepts and Problems	Math Total	Language Mechanics and Expression	Spelling	Total TABE battery score	
Comparisons										.44
Illustrations										
Instructions										
Orientation in Space III					.33,.36		.35,.42		.45,.39	.62
Analytic Perception										
Orientation in Space I										
Numerical Progression					.27,.42	.29,.38				
Categorizations										.73
Organization of Data										
Average				.28,.43	.34,.48					.59

[a]Both pretest and posttest correlations are > 2 SDs different from 0.

Table A-20

Correlations of Cognitive Skills Test and TABE and GT Scores (N pretest=53, N posttest=48)

	TABE--pretest, posttest[a]									
Cognitive Skills tests	Reading Vocabulary	Reading Comprehension	Reading Total	Math Computation	Math Concepts and Problems	Math Total	Language Mechanics and Expression	Spelling	Total TABE battery score	GT--posttest only
Map Reading							.34,.37		.38,.31	
Identification of Problem Dimensions										
Ordering										.49
Use of Common Objects			.30,.30							.53
Cognitive Vocabulary										
Generation of Problem Solutions										
Total Cognitive Skills Tests					.30,.39		.42,.44		.40,.34	

[a]Math pretest and posttest correlations are > 2 SDs different from 0.

Table A-21

Double Cycle Gains for Primary Analysis Group on Three Types of Instruments for January-April Cycle

Subtest	Means	(SDs)	Means	(SDs)	Means	(SDs)
	IE Test scores indicating proportions of correct responses					
	January (n=13)		February (n=11)		April (n=14)	
Comparisons	.64	(.37)	*.94	(.13)	.86	(.28)
Illustrations	.00	(.00)	.00	(.00)	.07	(.27)
Instructions	.23	(.22)	.23	(.24)	.34	(.19)
Orientation in Space III	.50	(.27)	.59	(.32)	.59	(.27)
Analytic Perception	.79	(.40)	.42	(.42)	.61	(.49)
Orientation in Space I	.21	(.24)	*.77	(.28)	.79	(.27)
Numerical Progression	.39	(.33)	.41	(.39)	.43	(.32)
Categorization	.41	(.41)	.59	(.37)	.60	(.34)
Organization of Data	.08	(.20)	*.76	(.40)	.79	(.36)
Average for IE Tests	.36	(.11)	.52	(.18)	.56	(.14)

Cognitive Skills Test scores indicating proportions of correct responses

	January (n=15)		February (n=12)		April (n=14)	
Map Reading	.64	(.25)	*.31	(.17)	.76	(.17)
Identification of Problem Dimensions	.38	(.29)	.33	(.25)	.26	(.19)
Ordering	.23	(.39)	.33	(.33)	.21	(.26)
Use of Common Objects	.31	(.24)	.28	(.19)	.28	(.19)
Cognitive Vocabulary	.50	(.19)	.51	(.19)	.61	(.14)
Generation of Problem Solutions	.62	(.46)	.75	(.34)	.79	(.38)
Average for Cognitive Tests	.45	(.18)	.50	(.13)	.48	(.11)

TABE scores indicating approximate grade equivalents

	January (n=16)		February (n=17)		April (n=16)	
Reading Vocabulary	5.9	(1.4)	*6.5	(1.6)	6.6	(1.5)
Reading Comprehension	5.6	(1.2)	*6.7	(1.6)	7.0	(1.4)
Reading Total	5.6	(1.2)	*6.5	(1.4)	6.7	(1.3)
Math Computation	6.2	(1.5)	*7.8	(1.9)	8.2	(1.6)
Math Concepts and Problems	5.9	(1.4)	*6.7	(1.7)	6.8	(1.5)
Math Total	6.1	(1.4)	*7.2	(1.6)	7.6	(1.3)
Language Mechanics and Expression	6.7	(1.7)	*6.8	(2.4)	6.8	(1.9)
Spelling	6.1	(2.4)	*6.8	(1.3)	6.8	(1.8)
Average for TABE subtests	5.3	(1.0)	*6.6	(1.3)	6.9	(1.2)

*Significant gains, $p < .02$

APPENDIX B

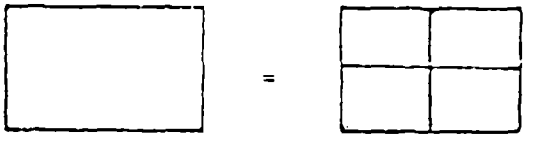
Lesson Plan

LESSON PLAN

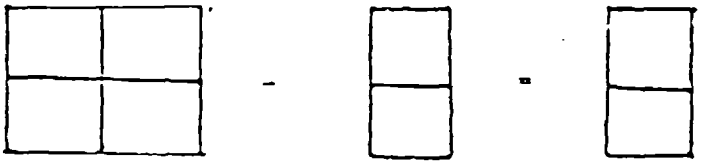
Basic Essentials of Mathematics

Objective: Students will automatically find ways of checking their work and will complete such checking.

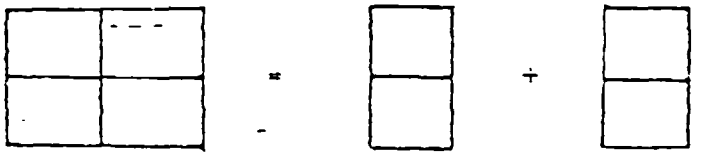
Introduce the concept of subtraction as the opposite of addition. For example, you can take a rectangle and divide it into four parts.



If you take away or remove two of those parts, you will have two parts remaining.



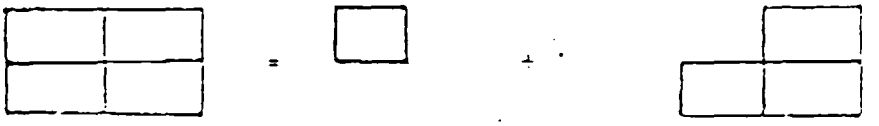
And if you add the two remaining parts to the two that you subtracted, you will have the rectangle of four parts.



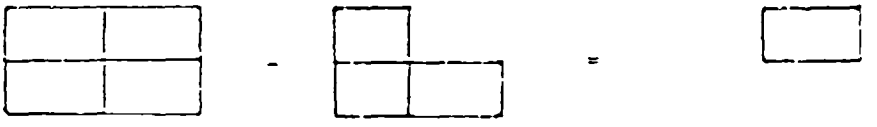
This figure of four blocks can be separated several different ways. Ask for the following examples.

Subtraction:

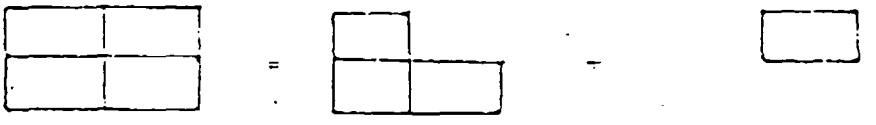
Addition:

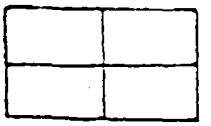
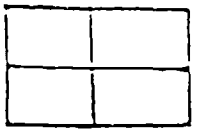


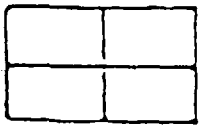
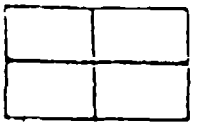
Subtraction:



Addition:



Subtraction:  - 0 = 

Addition:  = 0 + 

These examples show that the student can check his or her work in subtraction by adding the parts to see if they equal the whole. Similarly, he or she can check work in addition by subtracting one part from the whole to see if it equals the other part.

Introduce rows 1-4 on page 11 of the Basic Essentials of Mathematics (Part 1). Have students complete the problems and discuss them. Ask how they checked their work.

Turn to page 11 (or 12 or 13) of Organization of Dots. Have the students complete one row of frames. Then ask them to think about different ways of checking whether their answer is correct. Identify as many different strategies as possible for checking the work. Have the students complete the next row. Ask them to exchange booklets and to check their neighbor's work.

End the class with a discussion on the importance of checking one's work.

LESSON PLAN

Essential Skills (Book 16)

Objective: Students will learn strategies for scanning written material and for identifying the critical components.

Have the students turn to page 28 in Essential Skills (Book 16). Ask for the title--"Don't be Snowbound." What does this suggest about the contents of the passage? Get as many ideas as possible.

Now ask the students to spend a few seconds scanning the passage. What topics are mentioned in the paragraph? Make a list. What might be the main idea of the passage? Get as many suggestions as possible, and list them on the board.

Next, ask the students to read the entire passage and to answer the questions. Discuss each question and its answer. End the discussion by returning to the listings of topics and main idea. Which ones are appropriate?

Then ask about the title again. How does it help us to identify the topic and the main idea of the passage? How does the scanning of the passage help to set the framework? These are strategies that can be used when beginning to read new material.

Turn to page 10 (or 14) of Instructions. How can we apply these strategies? As the student scans the page, what does he or she see first, second, third, fourth, fifth, and so forth? Make a list of these items on the board. Ask the students to summarize the instructions. Then have them complete two rows. What kinds of answers did the students suggest? Which ones seemed most appropriate? If there is time, have the students complete the page and check with each other.

Finally, ask one of the students to summarize the strategies that can be used when reading any material.

LESSON PLAN

GED Test 2: The Social Studies Test

Objective: Students will learn how to read graphs and how to transform number progression into a graphical form.

Begin a discussion of taxation. Ask about the kinds of taxes that we pay: income tax
property tax
sales tax
inheritance tax
In what ways are these similar and in what ways are they different?

Read the selection on pages 56-59 of the GED Test 2: The Social Studies Test. Ask what kinds of taxes are being discussed in the paragraph.

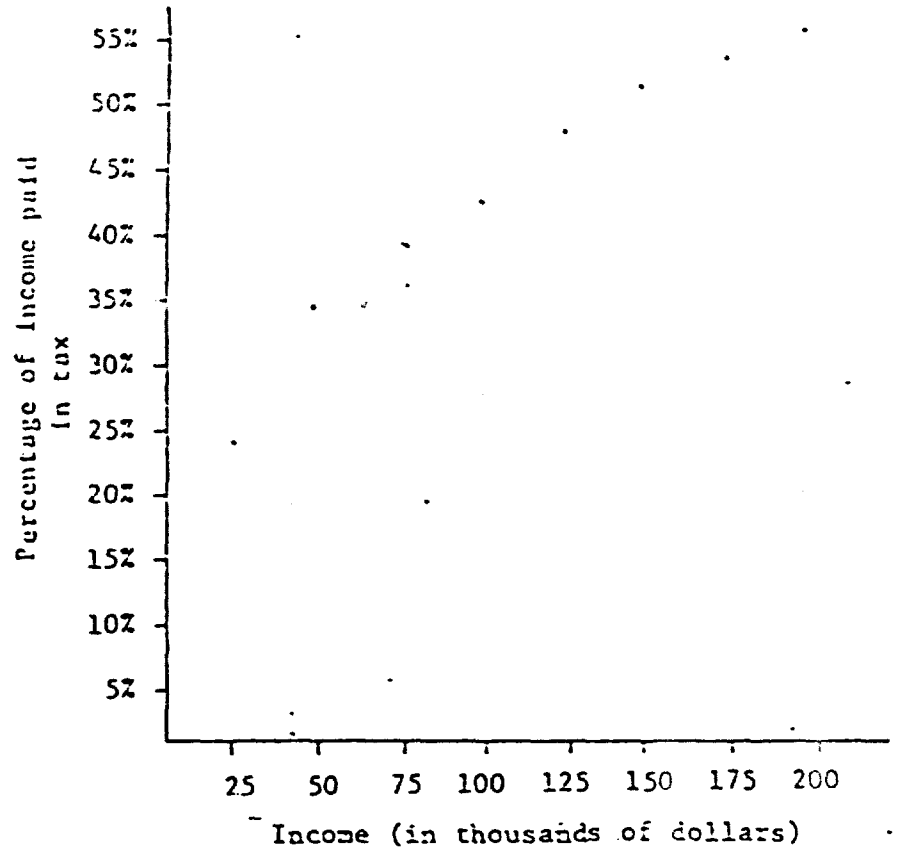
What does the chart in Figure 1 show us? Then discuss how to read this chart. For example, about how much tax does the person pay who makes $50,000 per year and about how much does the person pay who makes $25,000 per year?

Introduce page 13 (or 14, 15, 16) in Numerical Progressions. These provide a different example of a graph. Complete the page, and then ask people to read points on the graph.

Return to the reading selection on pages 56-59. The sentences from 13 to 20 discuss the percentage of income used to pay taxes. Are these percentages read off the chart? How are they calculated? What would be the formula for calculating the percentage of income paid in tax?-- Percentage = $\frac{\text{tax}}{\text{income}}$. Using this formula, how can we calculate this percentage for each income? Then show how we can graph these findings.

Figure 1

6/25 = 24%
17/50 = 34%
28/75 = 37%
42/100 = 42%
60/125 = 48%
77/150 = 51%
92/175 = 53%
110/200 = 55%



What we have graphed is the slope of Figure 1.

Now discuss the notion of a progressive tax--where you pay a larger percentage of your income for taxes as your income increases. What would be the opposite of a progressive tax--a regressive tax. Ask for a definition and for some examples.

Work through a case, for example using sales tax. Assume that sales tax is 5%. Thus, everybody, regardless of income, is taxed at the same rate. Right? But, let's see the effect of this tax on two families: the Smith and Jones families. Certain items, such as food, are considered to be basic necessities. This means that people must spend at least a certain amount to survive. Let us assume that a minimal amount that a family of four must spend on food is $1,000 per year. The Smiths spend $1,000 per year on food, as do the Joneses. But the Smiths have an income of $50,000, while the Joneses have an income of $25,000.

	Smiths	Joneses
Income	$30,000	$25,000
Food expenses	$ 1,000	$ 1,000
Sales tax	.05 x $1,000 = $50	.05 x $1,000 = $50
Percentage of income paid in sales tax	$50/$50,000=.001	$50/$25,000=.002

Thus, the Jonses, who have a smaller income, pay a higher percentage of their income on sales tax. How could this be graphed to show that sales tax is regressive?

APPENDIX C

I.E. Test

TEST C
(Revised)

This is a continuation of the test being done as part of the evaluation of the Instrumental Enrichment Program.

PRINT YOUR NAME _____

YOUR RANK _____

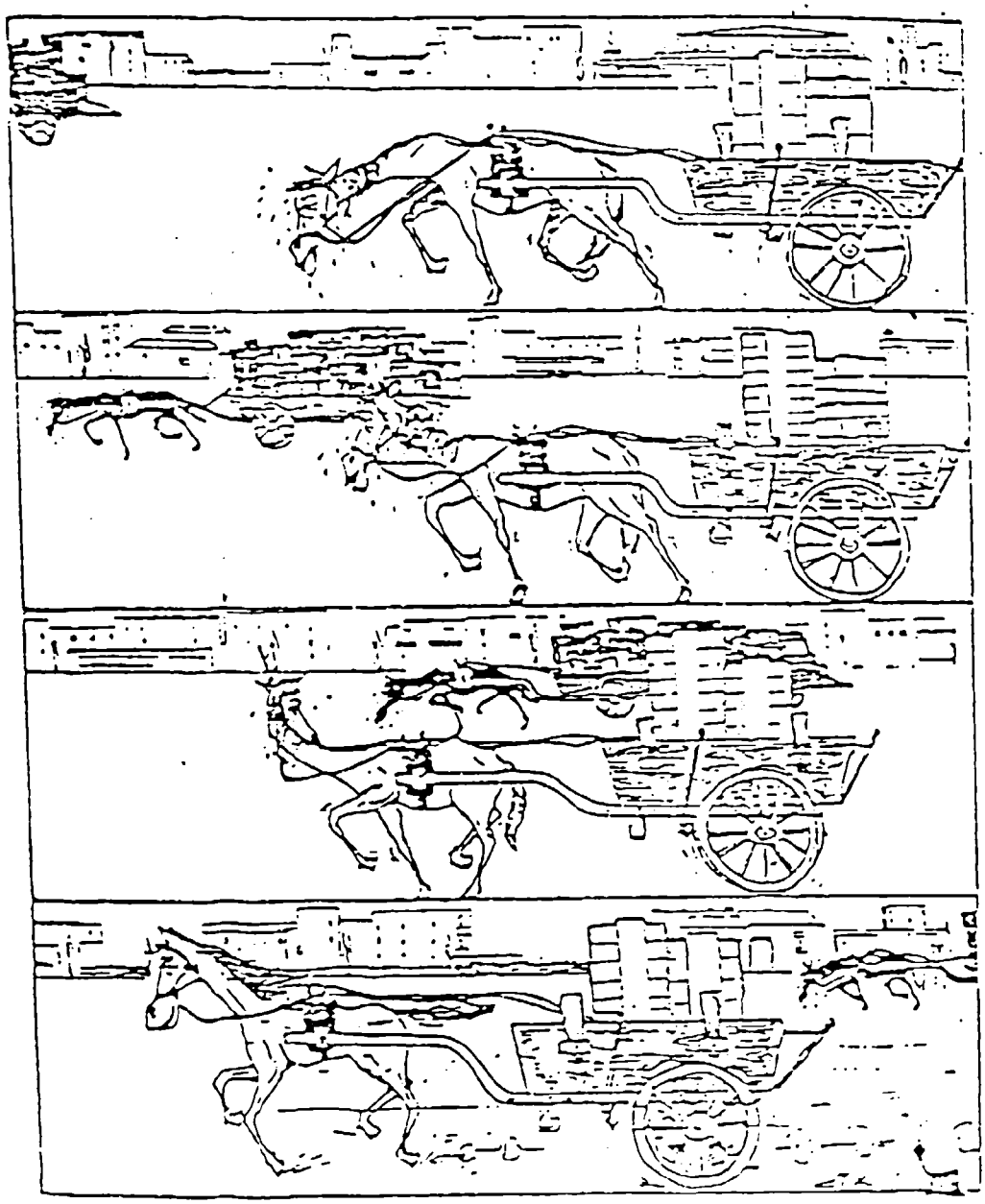
Choose two words that belong to the same group as the word on the left. Write the numbers of the words you choose and justify your answers.

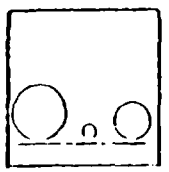
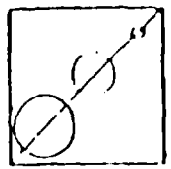
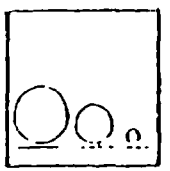
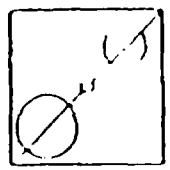
The following words will help you justify your choice:

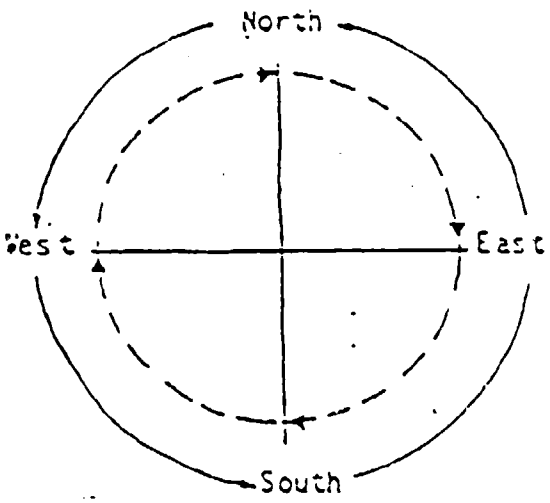
vocations	verbs
vehicles	geometrical figures
adjectives	feelings
musical instruments	

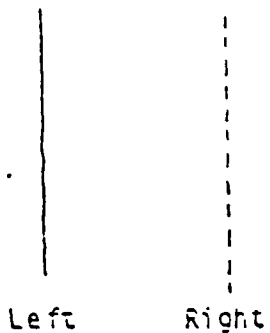
	Word	1	2	3	4	5
Example	Tailoring	Laugh	Engineering	Sleep	Food	Carpentr
	I chose words 2 and 5 because they are also vocations.					
	Piano	Flute	Dance	Violin	Picture	Sound
	I chose words __ and __ because they are also _____					
	Motorcycle	Speed	Boat	Helmet	Airplane	Wheel
	I chose words __ and __ because they are also _____					
	Jealousy	Sweet	Driving	Love	Hate	Reading
	I chose words __ and __ because they are also _____					

Describe what this cartoon means.



CORRECT THE PICTURES ACCORDING TO THE INSTRUCTIONS		CORRECT THE INSTRUCTIONS ACCORDING TO THE PICTURES	
Draw three circles in size order on the line in the square. The biggest circle is on the left side.		Draw three circles in size order on the diagonal, starting from the lower right corner. The smallest circle should be lowest.	
Draw three circles in size order on the line in the square. The biggest circle should appear on the right side.		Draw on the diagonal, starting from the lower left corner: three circles according to size. The biggest circle is on top.	





1 turn = 1/4 circle
2 turns = 1/2 circle
3 turns = ____circle
__ turns = full circle

Look at the above and fill in the blanks below.

You are facing north.

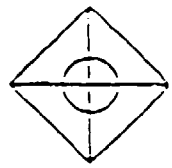
A. Make 4 turns to the right and 1 to the left. Where did you end up? _____.

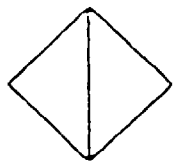
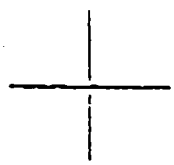
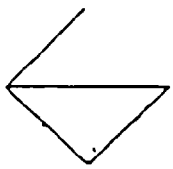
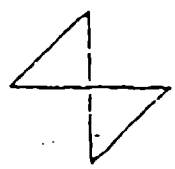
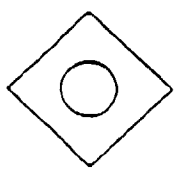
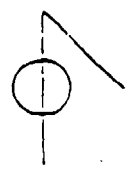
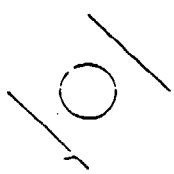
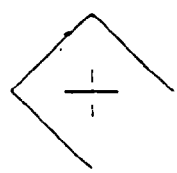
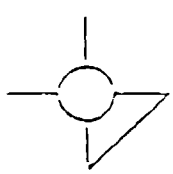
B. Make a full circle to the right and 1/4 circle to the left. Where are you now? _____.

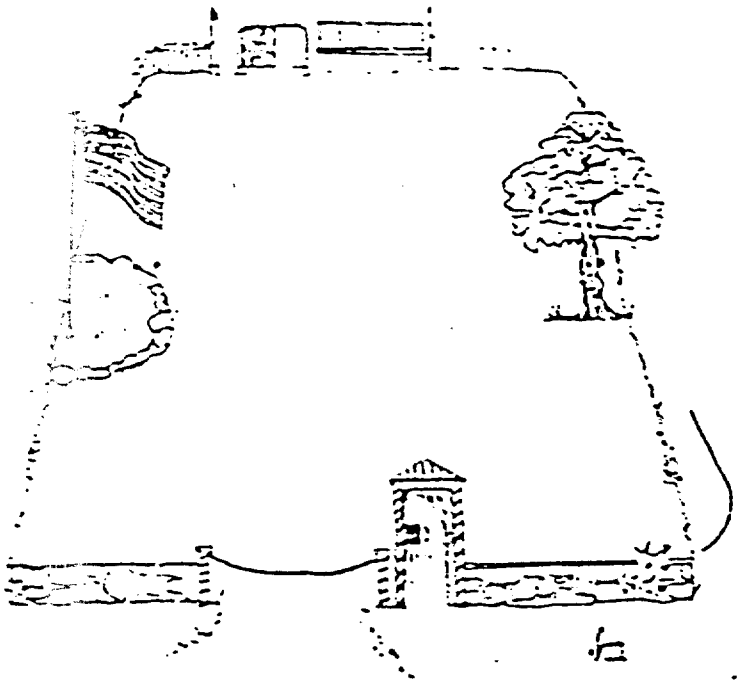
One turn = _____circle. _____ turns = 3/4 circle.

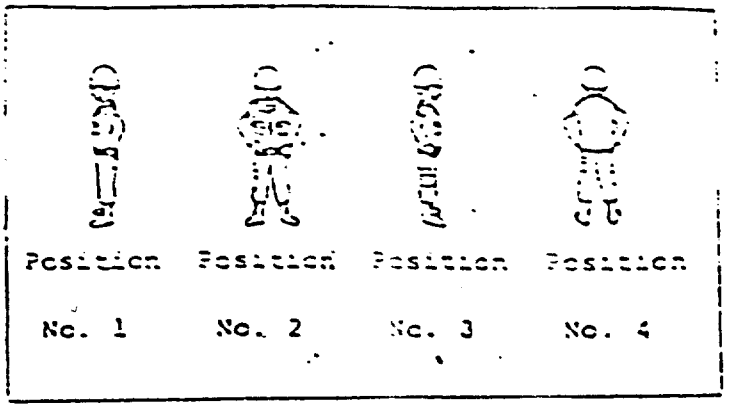
Correct the errors.

Look at the design at the top of the page. Each drawing on the left, when combined with a drawing on the right will form the design at the top of the page. You are to correct the answers by changing the letters or numbers so that the correct combinations are listed.



Incorrect		Correct	
1		A	
1-D			
2		B	
2-C			
3		C	
3-E			
4		D	
4-F			
5		E	
5-A			
6		F	
6-B			





IV. Fill in what is missing:

Position	Object	Direction in Relation to the Soldier
1	The tree	
4		right
2		back
	The barracks	front
3	The flagpole	
2	The barracks	
	The tree	left
4		back
	The flagpole	
		left
3		back
4	The tree	
		right

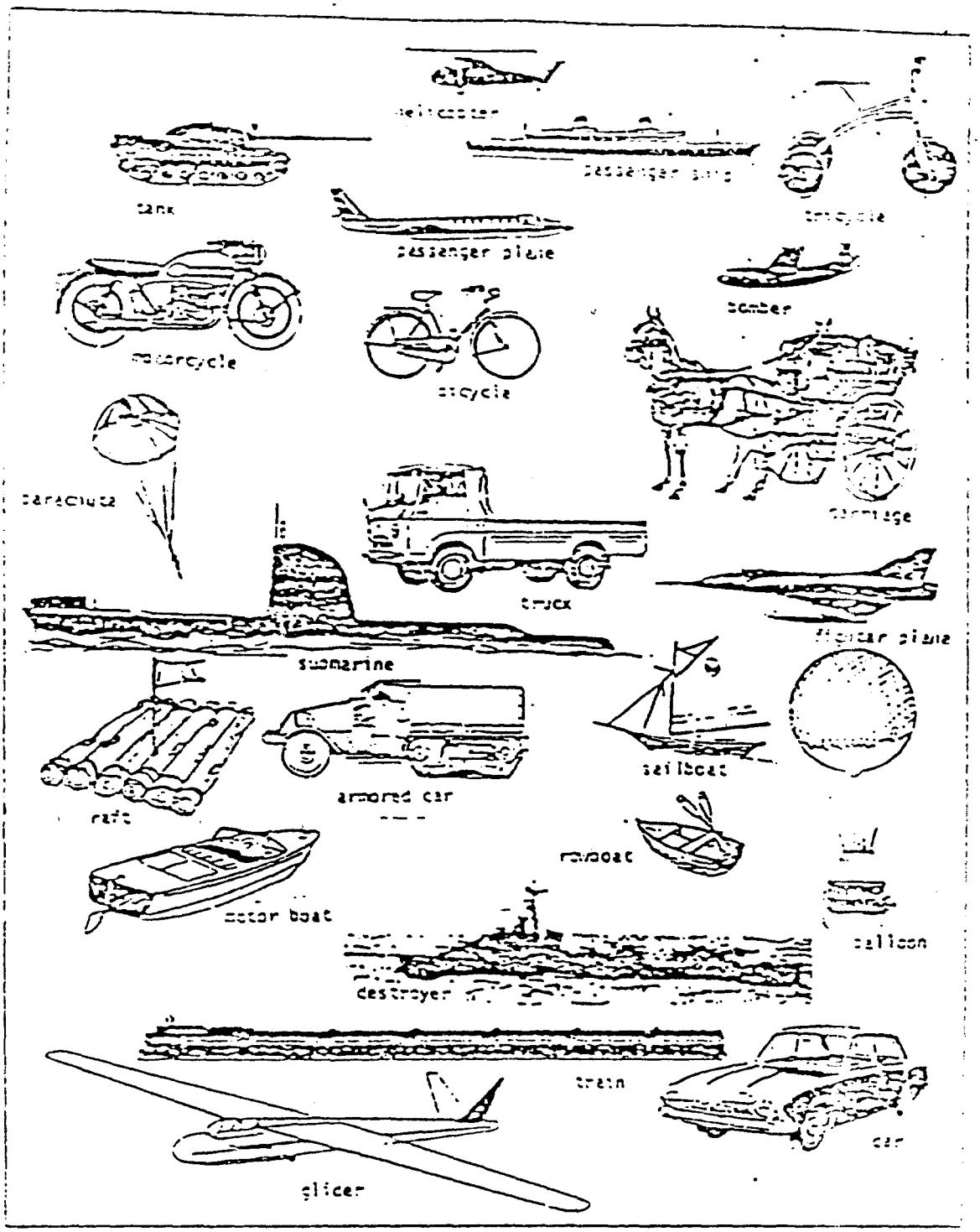
Complete the following progressions:

(A) 2 2 4 6 10 _____ 26

(B) 4 4 5 5 4 4 5 _____ _____ ____

(C) 1 11 10 20 19 29 _____ _____

(D) 2 6 11 17 24 _____



What is common to all objects? _____

_____

Find a general name for all these objects. _____

_____

How are these objects similar and how are they different?

Tank/fighter plane:

similar: _____

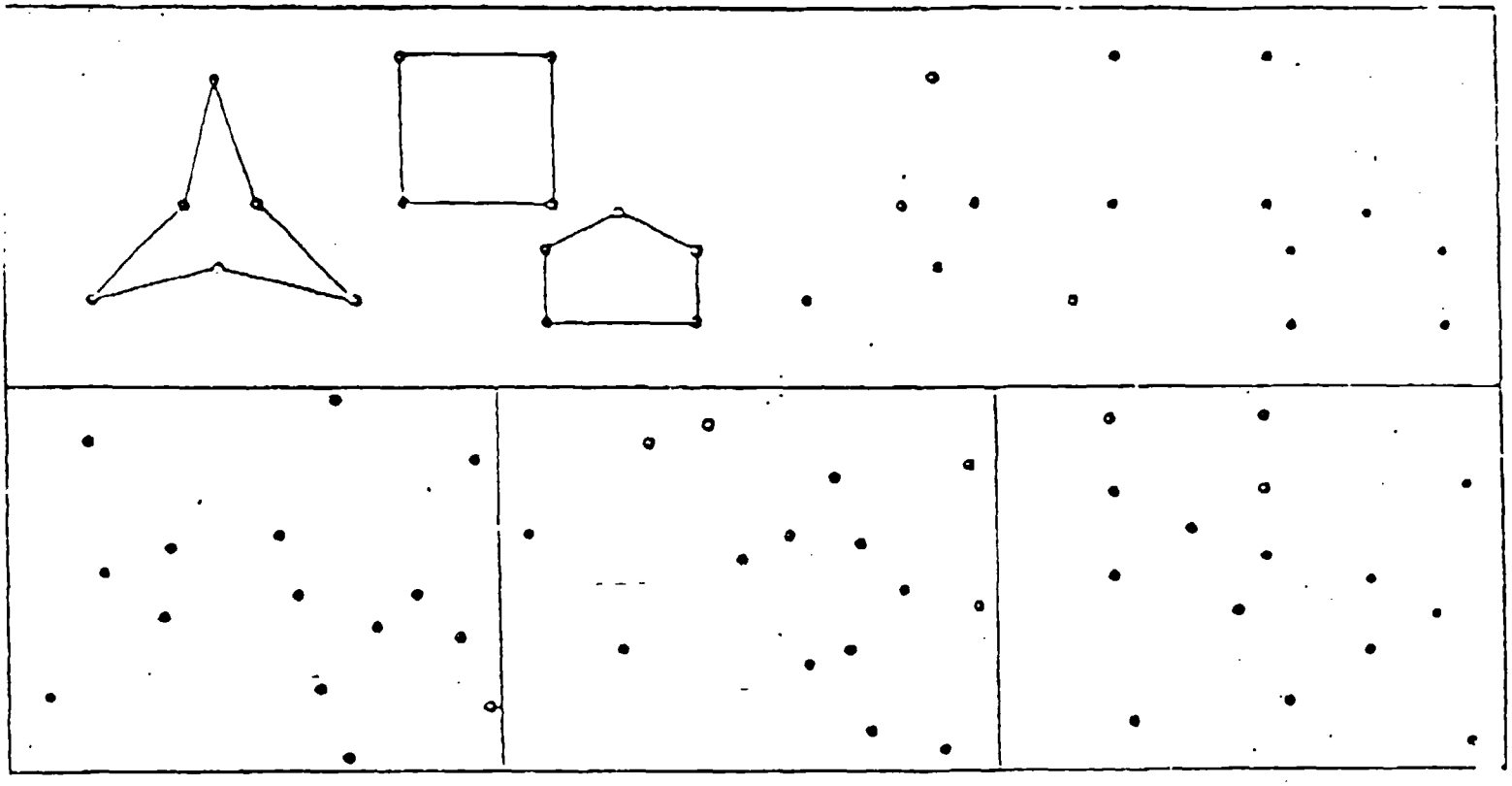
different: _____

Bicycle/sailboat:

similar: _____

different: _____

Connect the dots as shown in the example below. The completed figures can overlap, but they will not use the same dots.



APPENDIX D

Cognitive Skills Test

TEST A

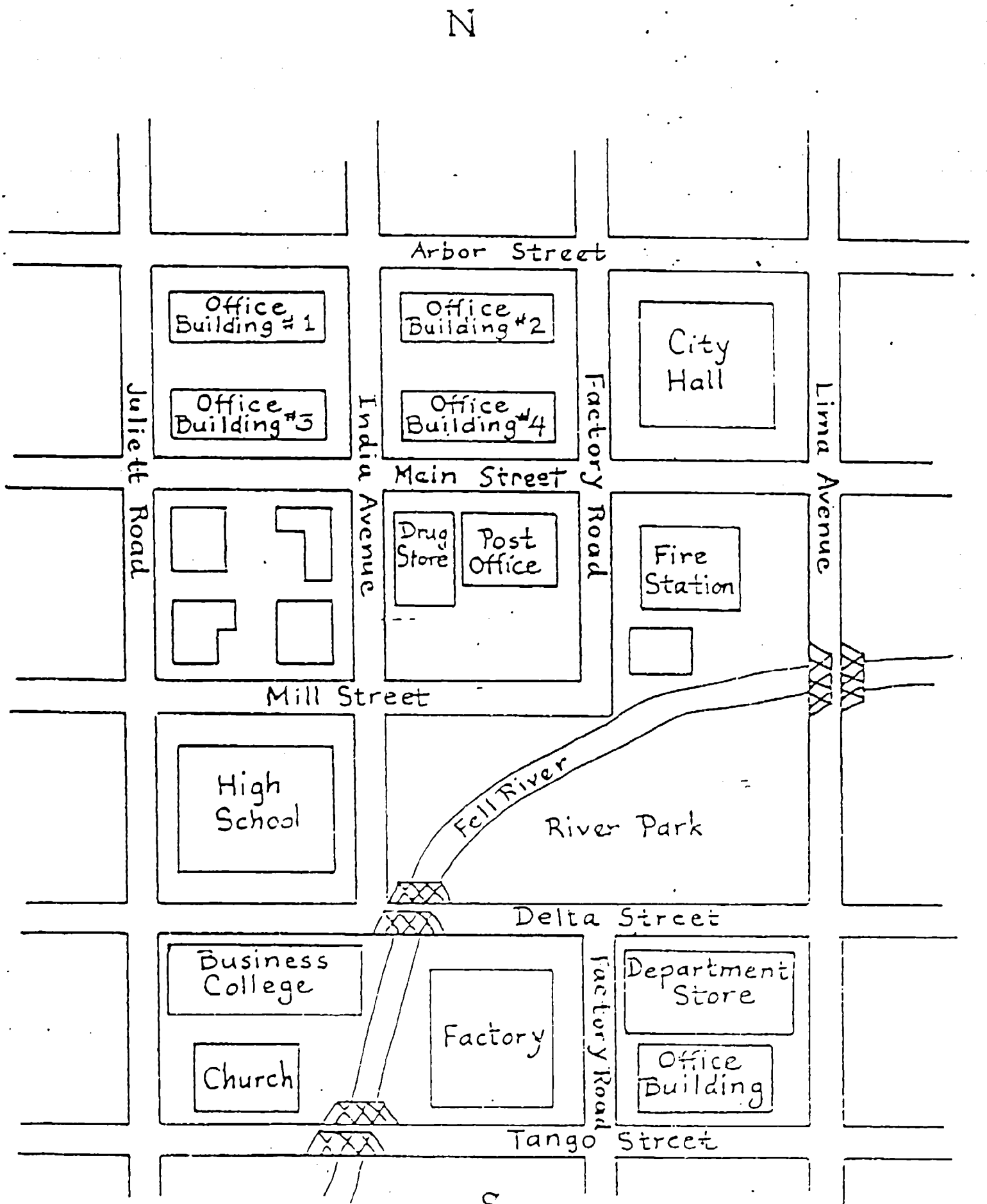
(Revised)

This is a test to see how well you know certain skills that are to be taught in the Instrumental Enrichment Program. The Instrumental Enrichment Program is being tried out as a part of the Basic Skills Education Program (BSEP II) at Fort Knox.

The results of your work on this test will be used as part of the evaluation of the Instrumental Enrichment Program. The evaluation will assess the effectiveness of the program and recommend improvements that are needed.

PRINT YOUR NAME _____

YOUR RANK _____


N
Arbor Street
Office Building #1
Office Building #2
City Hall
Office Building #3
Office Building #4
Juliett Road
India Avenue
Factory Road
Lima Avenue
Main Street
Drug Store
Post Office
Fire Station
Mill Street
High School
Fell River
River Park
Delta Street
Business College
Factory
Department Store
Church
Office Building
Tango Street
S

You are on a reconnaissance mission. On page 2 is a map of the area. (Refer to this map when answering Questions 1 to 6 below.)

1. Describe the location of Office Building #4.

_____

_____

2. Assume that you are inside the Business College facing the Fell River. Which building is to your right?

   a. High School
   b. Factory
   c. Church
   d. None of the above

3. Assume that your are walking along the Fell River from the Business College to the Fire Station. In what direction are you walking?

   a. Northeast
   b. North
   c. East
   d. Northwest

4. Your are now on Main Street facing the Post Office. What building is to your right?

   a. Drug Store
   b. Fire Station
   c. Office Building #4
   d. City Hall

5. You climb the steps of the Post Office and then turn around to face Main Street. Describe what you would see.

_____

_____

6. From the Main Street entrance to the Drug Store you walk to the Main Street entrance to the Fire Station. In what direction are you walking?

   a. North
   b. Southwest
   c. East
   d. West

7. List the things that you would consider in answering the following question. How would you decide how many soldiers to assign to a task? You would consider: _____

_____

_____

8. List the things that you would consider in answering the following question. How would you help a friend decide whether to reenlist? You would consider: _____

_____

_____

9. You are on guard duty in a combat zone. You hear someone approaching your position. The following is a list of actions, but they are in the wrong order. Put them into the correct order.

Wrong Order	Correct Order
a. Again you order "Halt!"	1. d
b. Stranger gives the password.	2. _____
c. You ask "Who is there?"	3. _____
d. You hear someone approaching.	4. _____
e. You order "Halt!"	5. _____
f. Stranger identifies himself.	6. _____
g. You order "Advance to be recognized."	7. _____
h. You give permission to pass.	8. _____
i. You ask for the password.	9. _____

10. You have come upon a soldier with a bleeding wound in his leg. You put on a field dressing and a pressure dressing, but the bleeding did not stop. The following are the steps in putting on a tourniquet, but they are in the wrong order. Put them into the correct order.

Wrong Order	Correct Order
a. Put a stick under the knot.	1. i
b. Get medical help.	2. _____
c. Get the soldier's belt.	3. _____
d. Tie one end of the stick down so it will not unwind.	4. _____
e. Make a "T" on his forehead with a grease pencil.	5. _____
f. Place the belt close to the wound between the wound and his heart.	6. _____
g. Tie a knot in the belt.	7. _____
h. Twist the stick just enough to stop the bleeding.	8. _____
i. Find a stick.	9. _____

11. Sometimes you may be in the field, and you may need something that is not available. For example, you have to stay in the field at night in the rain, but you have neither a tent nor a ground cloth. In this case, you could use a rain poncho as a substitute for the tent or the ground cloth. Thus, the rain poncho has several uses in the field.

Item	Uses in the Field
rain poncho	rain coat, tent, ground cloth

Write as many uses in the field as you can for the following items.

Item	Uses in the Field
shoe string	
baseball cap	

12. In each row below, circle the word or phrase on the right that is closest in meaning to the word on the left. For example:

little a. big b. child c. small d. young

The correct answer was "small."

systematic	a. dirty	b. automatic	c. orderly	d. disarray
accuracy	a. exactness	b. mistake	c. rigidity	d. motorist
strategy	a. cleverness	b. speed	c. warfare	d. plan
hypothesis	a. test	b. law	c. assumption	d. evidence
classify	a. shine	b. assist	c. draw	d. group
focus	a. blur	b. photograph	c. label	d. center
similarity	a. likeness	b. current	c. difference	d. study
attribute	a. agent	b. admiration	c. characteristic	d. sensation
orientation	a. race	b. circle	c. pointer	d. direction
organize	a. shuffle	b. arrange	c. finish	d. sing

13. One of the platoons in your company went on patrol. They were late in returning to base, but radioed that all was "O.K." The company was put on alert. Why? (Give a possible explanation.)

14. You have been invited to a party on Saturday night. You arrive on time, but nobody is at the club. Why? (Give a possible explanation.)

APPENDIX E

Classroom Observation Form

DEMONSTRATION OF INSTRUMENTAL ENRICHMENT PROGRAM

BASIC SKILLS EDUCATION PROGRAM — FORT KNOX

Classroom Observation Form

Teacher name _____

Subject _____

Date _____

Time at beginning of class _____

1. Number of students in class _____

2. Arrangement of students' desks.

2. Instrument and pages covered _____

3. Major points made in I.E. instruction.

   a. Introduction

      Time began _____

      Questions asked by teacher (check all that were used)

      ____ 1. What do you see on the page/or on the first two rows of the page?
      ____ 2. What looks familiar to you?
      ____ 3. What is "new" on the page?
      ____ 4. What vocabulary or words do we need to discuss this page?
      ____ 5. What cues indicate the directions for starting the page or for doing the exercises? (If there are printed instructions, teacher should focus on key words and main ideas.)
      ____ 6. How can we check our work to eliminate possible errors?
      ____ 7. Other:

      Major points

      Time ended _____

KEY

A=Analytic perception

B=Bridging

C=Checking

E=Explanation of alternatives

L=Labels

O=Ordering of steps

P=Perspectives

R=Reasoning

S=Strategy

(Classroom Observation Form, cont'd.)

b. Independent work

Time began _____

Teacher activities (check all that were used)

____ 1. Goes from student to student and observe work.
____ 2. Offers individualized assistance.
____ 3. Reinforces successful mastery.
____ 4. Initiates discussion of problems with individual students or several students together.
____ 5. Other:

Student activities (check all that apply)

____ 1. Works individually
____ 2. Checks responses with others
____ 3. Offers assistance to others
____ 4. Other:

Time ended _____

c. Discussion

Time began _____

Questions asked by teacher (check all that were used)

____ 1. What strategies did we use to solve these problems?
____ 2. Was one strategy more appropriate than another?
____ 3. Which tasks were most difficult? Why?
____ 4. Think of an example of how what we were doing on the page relates to our daily lives and/or problems related to learning math, science, art or music, etc.
____ 5. Other:

Bridges suggested

By teacher -

By students -

Major points

Time ended _____

(Classroom Observation Form, cont'd.)

d. Summary

Time began _____

Restatement of objectives

Student evaluation

Time ended _____

e. Vocabulary list:

4. Classroom atmosphere (Record positive or negative examples in the following areas)

Cooperation among students

Participation in discussion

Attention to discussion

5. Problem areas for students.

6. Level of student interest in I.E. materials.

___5. Very interested

___4. Interested

___3. Mildly interested

___2. Somewhat uninterested

___1. Definitely uninterested

7. Suggestions for improvements in materials.